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REVISION OF THE *ATHALIA* GROUP OF THE GENUS *MELITAEA* FABRICIUS, 1807 (LEPIDOPT., NYMPHALIDAE)

By Roger Verity, M.D., F.R.E.S.

[Read 19th October, 1938.]

With Plates 1–14.

General Remarks.

The object of the present paper is to carry on the work of unravelling the confused state, which has hitherto existed in the *athalia* group of the genus *Melitaea* Fabricius, owing chiefly to the fact that the distinctive features visible to the naked eye of its species, subspecies, races, or local forms, as best one likes to call them, and somations, of which I shall speak presently, are utterly insufficient to identify with certainty every individual, because in many cases these features are not at all constant and furthermore are masked by a great deal of parallel variation.

The discovery made by Suschkin (1913, *Z. wiss. InsBiol.* **9**) and later, independently, by Reverdin (1920, *Bull. Soc. ent. France* **1920**: 319–321, fig. genit.) that the male genital armature offered specific characters in these butterflies which were much more distinctive than those offered by the other organs, has revealed many mistakes and has shown the need for several fundamental changes, beginning with the specific groups. In a paper which I published in 1930 (*Ent. Rec.* **42**), I made a number of these corrections, chiefly by pointing out the existence of the widespread species *M. britomartis* Assmann, which had been confused in part with *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) and in part with *M. athalia* (Rottemburg). This error had been until then the chief cause of confusion, a confusion which the examination of the genitalia was the only way of clearing up.

In this and in other cases I was, however, at that time obliged to make use of the knowledge obtained in that line by the authors referred to above, and I was thereby satisfied that it was indispensable to obtain further information before coming to definite conclusions on a great many doubtful points. I have therefore devoted considerable time and labour to the achievement of this object. The results are given in the present paper.

I wish, first of all, to acknowledge most gratefully the help which I have received in this task from the following entomologists, without whom I could never have carried it through: Monsieur F. Le Cerf, who has allowed me to photograph Frühstorfer's specimens in the Paris Museum and to dissect the male genital armatures; Mr. N. D. Riley, who has sent me information about specimens in the British Museum (Natural History), as well as photographs and dissected armatures; Dr. L. G. Higgins, who examined some of the specimens for me; Prof. Titschack, who sent me, on loan, the material of this group from the Fixsen and Graeser collections, preserved in the Hamburgisches Zoologisches Museum; Herr O. Bang-Haas, who has sent me, in the same way, "original" specimens preserved in the Staudinger collection; the Directors of the Geneva Museum, who have sent me Reverdin's collection of slides; the late Dr. W. Horn of the Deutsches Entomologisches Institut of Berlin-Dahlem; Prof. Hormuzaki, who has furnished me with some of his paratypes; Dott. Rocci,

who has given me full accounts of the materials in his collection, the whole of which I have now acquired; Herr Rutimeyer of Berne, who gave me several important examples and undertook to collect topotypical examples of *M. athalia* Rottemburg exerge *helvetica* Rühl for me. Last, but not least, I owe my best thanks to the Royal Entomological Society of London for publishing this Monograph and to Mr. Francis Hemming for the very considerable amount of labour and interest which he has devoted to it in seeing it through the press for me.

I am thus able to figure a large number of types and paratypes, which will, I hope, greatly facilitate determinations and prevent in future the dreadful confusion which has gone on hitherto in the application of the various names. I also figure the male genital armatures as broadly as possible to show the variations, as well as the resemblances, by which the specific and the subspecific grouping has at last been achieved in a satisfactory way, being founded on facts, the value of which readers can judge for themselves.

The first general remark to make, however, is that the male genitalia afford in no way always an infallible method of determining single specimens or of distinguishing between groups of races. As a rule they do so, but there are species and races, as will presently be seen, which constitute exceptions. On the other hand, it may also be seen that some of these exceptions are apparent only and may mislead those who are not sufficiently acquainted with the subject. In probably no group of butterflies more than the present have the genitalia primary importance, but even so they must not be considered without reference to the other organs of the insect and the evidence which can be drawn from these and biological data. The latter have often made one observe the characters of the genitalia more accurately and have led to the discovery of minute differences which had previously escaped notice.

This warning cannot be repeated often enough owing to the danger of blind faith being placed in the appearance of genitalia and of wrong interpretations being made from them, which continues to persist even in recent works of entomologists who have studied those organs considerably. Warren has shown this to have happened in connection with several species of *Pyrgus* Hübner, [1819] among the HESPERIIDAE, and here, in the Melitaeidi, a serious mistake has quite recently been made, strangely enough, twice over, by two authors, quite independently of each other. Hormuzaki (1934, *Bul. Fac. Sti. Cernauti*) and Agenjo (1934, *Eos, Madrid* **9** : 311–320 1 pl.) have agreed that *helvetica* Rühl (= *pseudathalia* Reverdin) must be conspecific with *M. deione* (Geyer), because they had not been able to detect the slightest difference in the genitalia. The latter author controverts the statement made in my paper of 1930 in regard to certain Spanish races to *M. athalia* Rottemburg exerge *helvetica* Rühl, since in his opinion these races are referable to *M. deione* (Geyer), because, in his view, no race of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) occurs in the Iberian peninsula.

Anyone possessing field experience of these species knows that in nearly all its haunts *M. deione* (Geyer) (including the very *athalia*-like race *berisalii* Rühl in the Valais) is always to be found in company with exerge *helvetica* Rühl, but that the individuals of the two species are recognisable even on the wing by their different behaviour. For example, *M. deione* (Geyer) is fond of paths and other stony places, whereas *helvetica* Rühl hovers over the grassy areas. On closer examination one never finds a single individual resembling the other species to the extent of leaving one in doubt as to which it belongs. A more perfect specific distinction could not, as a matter of fact, be conceived, so that it affords

a remarkable proof of the way in which resemblance of the genitalia can be nearly as misleading as the resemblances visible to the naked eye, which formerly led entomologists to mistaken conclusions regarding the content of specific groups in many cases.

It must, however, be added that the resemblance of the genitalia of *M. deione* (Geyer) and of exerge *helvetica* Rühl is not at all as absolute as Agenjo and Hormuzaki believed it; they had evidently not detected the minute, but perceptible and, apparently, constant distinctive characters described by Reverdin: in *helvetica* Rühl the terminal or posterior process of the clasp has only two spines, of which one is apical and the other rises a little lower down on the hind-edge; the remainder of both edges is quite smooth. In *M. deione* (Geyer), on the contrary, there are at least two, and usually more, spines along the hind-edge, very small, but plainly visible; the one at the extreme root of the process is particularly constant, whereas it is never present in *helvetica* Rühl. The other character is afforded by the harpe or lateral or anterior process, shaped like a claw or a horn, which has a regular curve in *M. deione* (Geyer), whereas in *helvetica* Rühl it is bent more sharply into an angle, at about one-third of its length, the portion which follows being nearly straight. These differences are quite clear even in Agenjo's figures, of which fig. 2 on Pl. 10 is, in reality, referable to *M. deione* (Geyer), whereas Nos. 1 and 3 on the same plate are referable to *helvetica* Rühl. The same character can be seen by comparison of the figures (Pl. 10, figs. 267–271 and Pl. 11, figs. 272–277), which I give of *helvetica* Rühl, with those (Pl. 10, figs. 263–266) which I give of *M. deione* (Geyer), although in fig. 264 the third spine of the terminal process is extremely minute. Any possibility of the specific identity of these two insects must, therefore, be most positively discarded on the strength of the varied evidence available.

Let me now go over the facts which I have found by working out the male genital armature of this group of the genus *Melitaea* Fabricius, since I dealt with it in 1930, and see to what extent the hypotheses which I then made and the conclusions which I then drew in regard to each of the questions which arose have been either sustained by the new evidence obtained or require to be modified or corrected.

I continue to use the term " race " employed in my previous papers to designate the variations, which have been recorded in the general, average, aspect of populations from different regions or localities, not because I am convinced it defines at all exactly the nature of those variations in the hereditary sense, similar to the one of " breed," usually attributed to it, but because the term " subspecies," used in the more recent original descriptions and in the latest catalogues, seems to me still less appropriate in the great majority of cases. A few of these populations are, no doubt, really " species in the making " as the meaning of " subspecies " should imply, but many are, no less certainly, of a totally different nature, which has nothing to do with hereditary differences and with sterility *inter se*, necessarily connected with the tendency to specific distinctness, if the term " species " is to have any definite meaning. The differences of aspect which they exhibit are simply the result of development in different surroundings, which act on each individual, during the successive stages of its life-cycle, and produce different facies from perfectly similar hereditary complexes. Students of genetics designate by the term " somation " the variations which occur in the soma independently of hereditary factors, and the right policy in systematics, in order to obtain exact and definite results, would be to ascertain which cases fall under this heading and to use the term " somation " to distinguish them. Unfortunately, however, it is as yet far

from possible to do so, since a considerable amount of experimental work will be necessary before it will be possible to attain this end. For the present, this phenomenon may only be established in the small number of cases in which proofs can be detected under natural conditions. This occurs particularly when forms, which are characteristic in some localities and seem hereditarily fixed there, are on the contrary found in others as seasonal variations, one constituting the first generation and the other the second generation. I show later that this happens, for instance, in *M. athalia* (Rottemburg) with the very different races *submaxima* Verity and *tenuis* Verity of exerge *helvetica* Rühl, and in France with races *beata* Caradja and *completa* Verity of *M. parthenoides* Keferstein, the second of these forms existing in each case both as an apparent race in dry continental surroundings, and as the second generation of the first in damp ones of the coastal region. Another type of proof to the same effect is much more frequent than one has hitherto realised and consists in the fact that forms, which seem racial in damp and cold surroundings and in hot dry ones respectively, are suddenly found to replace each other, in a most striking and unexpected manner, in both those surroundings, when these habitats change their character, owing to the exceptional weather of some years. Southern countries are particularly instructive in this sense, when collecting is carried on regularly year after year in the same localities.

It does not seem of any value to replace the term " race " by the term " local form," as some authors have lately done, since the latter term is not correct in those cases (which are the most numerous) in which the characteristic form is by no means entirely local but occurs as a minority in other localities where another form characterises the race by its greater abundance. Moreover, as already noted, the percentages in which two forms occur may vary very much from one year to another even in a single locality.

When further knowledge is obtained, it will be possible to determine what is the right terminology to employ; and in the meanwhile it is better to abstain from changes in terminology. The term " somation " would, however, in fact be the correct term to adopt for a good many both of what are at present known as " races " and of the so-called " subspecies " of those authors who employ that term because it is recognised by the International Code.

1. *MELITAEA PACIFICA* Verity.

Melitaea pacifica Verity, 1932, *Ent. Rec.* **44** : 71; *Melitaea plotina* Bremer, Staudinger *nec* Bremer, 1892, *in* Romanoff, *Mém. Lép.* **6** : 187; *Melitaea plotina* Bremer, Seitz *nec* Bremer, *Grossschmett. Erde* **1** : 223, pl. 67, fig. C 5.

In naming this species, I drew attention to the original figure of *M. plotina* Bremer and pointed out that the insect which Staudinger and more recently Bang-Haas distributed under the name *plotina* Bremer (and which was so figured by Seitz) is in reality a very distinct and peculiar species which had not previously been named or properly described. At the same time, I showed that the true *plotina* Bremer was one of the races of *M. britomartis* Assmann, to which reference is made later in the present paper (p. 649). In my description of *M. pacifica* Verity, I laid stress on its general resemblance in aspect to *M. ambigua* Ménétriés. I noted also that the genitalia figured by Suschkin (1913, *Z. wiss. InsBiol.* **9** : 323, fig. 27) as that of *M. plotina* Bremer were very similar to the genitalia of *ambigua* Ménétriés figured by Reverdin (1922, *Bull. Soc. lép. Genève* **5** : 24–45), from which I drew the conclusion that the genitalia figured by Suschkin were prepared from a specimen of the insect distributed by Staudinger as *plotina* Bremer, *i.e.* from a specimen of *M. pacifica* Verity. This speculation

is now confirmed by the examination of the genitalia of specimens of *M. pacifica* Verity in my collection, as will be seen from the figure which I give (Pl. 10, fig. 254). This figure shows that the genitalia have the same narrower and more elongate tegumen characteristic of *M. ambigua* Ménétriés (Pl. 10, figs. 255–262) as opposed to that of *M. athalia* (Rottemburg); and that they end in an uncus consisting of two very long straight rods rising nearer to each other than in *M. athalia* (Rottemburg), these rods being of more equal length from base to apex (compare pl. 12, fig. 302). A peculiarity exhibited by *M. pacifica* Verity, which I have not seen in any other species of the genus, is that these rods of the uncus bear a row of minute but sharp and distinct spines along their inner edge, in the apical third of its length.

M. pacifica Verity is thus a very distinct species, standing closest to *M. ambigua* Ménétriés. Its relationship to that species is apparently very similar to that of *M. britomartis* Assmann to *M. athalia* (Rottemburg), in view of its small size and its heavy underside markings together with the rich warm tone of the russet tints and the way in which this colour fills the space between the two marginal capillary streaks, precisely as in *M. britomartis* Assmann and in *M. diamina* (Lang) (= *M. dictynna* (Esper)), a feature never seen in *M. athalia* (Rottemburg) or other allied species.

(i) *M. PACIFICA* Verity race *PACIFICA* Verity.

Pl. 1, figs. 1, 2 ♂, 3 ♀; Genitalia pl. 10, fig. 254.

This race was described from specimens taken at Troiz Kossowsk (800 m.) on the Tshikoi river in the south-west of the Province of Transbaikal. The figure given by Seitz under the name *plotina* Bremer (to which reference has already been made) is quite a good illustration of the underside of the male. At the time that I named this insect the female was not known. As will be seen from the figure now given (Pl. 1, fig. 3), this sex differs from the male, and also from the female of any eastern race of either *M. athalia* (Rottemburg) or *M. britomartis* Assmann. The female in this species is much larger than the male, the length of the fore-wing being 20 mm. as compared with 15 mm. in the male; in fact this sex looks almost twice as large as the male. The shape of the fore-wings is extremely elongated; the central S-shaped band is very thin, as compared with the premarginal bands, with the result that in general facies the female of this insect is rather similar to that of an example of the same sex of *M. parthenoides* Keferstein. The same resemblance is exhibited on the underside of the fore-wing by reason of the almost complete obliteration of the black markings and of the thinness of those which remain. In one specimen in my collection the fulvous portion on this surface of the fore-wing is of an unusually rich chestnut tone. On the hind-wings the russet bands and spots are very small and are in part replaced by yellow. The central white spaces stand out as in *M. niphona* Butler in the form of small oval spots encircled by black rings. The marginal spaces are large. The space between the two marginal capillary streaks is of a distinctly golden yellow colour lighter than the russet of the male.

(ii) *M. PACIFICA* Verity race *USSURIAE* Verity.

Melitaea pacifica Verity race *ussuriae* Verity, 1932, *Ent. Rec.* **44** : 72.

The type of this race was taken at Sutshansky Rudnik near Vladivostok. This race differs mainly from race *pacifica* by its much larger size (length of fore-wing of the male 18 mm. as compared with 15 mm.).

2. *MELITAEA AMBIGUA* Ménétriés.

Melitaea athalia Rottemburg var. *ambigua* Ménétriés, 1859, *in* Schrenk, *Reisen Forsch. Amur-Lande* **2** (1) : 24, pl. 2, fig. 4 ♂.

Although at the time not recognised as having specific value, the characters separating the genitalia of *M. ambigua* Ménétriés from those of *M. athalia* (Rottemburg) from Europe were described and figured by Reverdin as far back as 1922 (*Bull. Soc. lép. Genève* **5** : 24–45, pl. 2, fig. 3). In particular, Reverdin noted the features of the uncus to which I have referred above in my description of *M. pacifica* Verity, the most characteristic of these features being the distinct indentation which the rods of the uncus exhibit on their inner edge just before the apex, which would be blunt in shape if it were not divided in this manner. Its outer portion forms a minute hook, bent inwards (as can be seen in that figure and as is shown in his fig. 1 on p. 28). The other features observed by Reverdin were (a) that the terminal processes of the valves have more teeth than in *M. athalia* (Rottemburg) and are noticeably divided into two portions by a very deep central incision, and (b) that the lateral processes (or " harpes ") carry large teeth on their proximal half only. The aedeagus (penis-sheath) is similar to that of *M. athalia* (Rottemburg).

It is interesting to note that the characteristic notched uncus of *M. ambigua* Ménétriés is similar to that of *Phyciodes tharos* (Drury) of the temperate parts of North America, except that in the latter species the free ends of the rods are not so long. In view of the fact that most of the species of *Phyciodes* Hübner have no uncus at all, my hypothesis that the species of the *athalia* group of the genus *Melitaea* Fabricius have probably been derived from the *tharos* group of the tropical genus *Phyciodes* Hübner seems to be confirmed. In my previous paper I did not, however, suggest that *M. ambigua* Ménétriés was the most direct derivative of these species of *Phyciodes* Hübner, since I considered on the contrary that this species was a subtropical secondary derivative of *M. athalia* (Rottemburg), for I did not then know that certain species of *Phyciodes* Hübner had developed such an uncus. I thought, therefore, that the form of the uncus in *M. ambigua* Ménétriés was the result of caloripetal variation within the genus *Melitaea* Fabricius. It is, however, now clear that *M. ambigua* Ménétriés and *M. pacifica* Verity follow the general rule, which is to be noted in a large number of species occurring in eastern Asia, namely that they have preserved very ancient characteristics in common with species occurring in the Nearctic Region. In both cases these are presumably the ancestral features acquired in the great Polar continent at the time when the Holarctic Fauna of temperate climates came into being in that region, with the result that they are still found on both sides of the Pacific. Viewed in this light, *M. athalia* (Rottemburg), as contrasted with *M. ambigua* Ménétriés, would represent a further degree of frigoripetal variation than the last-named species, though on the other hand it is almost certainly not a derivative of it; for in this connection it must be remembered that *M. athalia* (Rottemburg) comprises within its orbit exerge *helvetica* Rühl and its associated races, which have no uncus at all, but nevertheless inhabit warmer and drier climates than those in which nominotypical *M. athalia* (Rottemburg) occurs. Further, it must be recalled that next to this species stands the still more extreme species *M. deione* (Geyer). I have just learned that exerge *helvetica* Rühl exists on the Pacific coast, and this is a further proof that it has not been produced from *M. athalia* (Rottemburg) as a result of its vast migration across Asia and Europe;

apparently one can only come to the general conclusion that all these branches are very ancient offsprings of the same group of species of *Phyciodes* Hübner, modified in a parallel way by the cooling of the climate in the Polar continent which they used to inhabit together. Morphologically, there certainly exists a series of species and races following each other in successive grades and leading from the nominotypical race of *M. ambigua* Ménétriés, through *M. athalia* (Rottemburg) and actual transitional forms from it to *helvetica* Rühl, the series culminating with *M. deione* (Geyer). Here, however, as in most similar cases which one meets with in nature, any attempt to find evidence to the effect that these grades have derived from each other in a direct way is entirely unsuccessful. As noted above, there is nothing to support the somewhat strained hypothesis that a subtropical species such as *M. ambigua* Ménétriés, after having turned into the species *M. athalia* (Rottemburg) of more temperate climates with a differently shaped uncus and terminal process of the valve, should have entirely lost this character, as in exerge *helvetica* Rühl and *M. deione* (Geyer), by returning again to warmer and drier climates. On the other hand, if one assumes (a) that the two latter are primitive forms derived from a species of *Phyciodes* Hübner closely related to *P. tharos* (Drury), but with no uncus, and (b) that *M. athalia* (Rottemburg) is a more recent derivation from them due to colder climates in Siberia during the time in which glaciation was going on in some parts of that continent, it is impossible to explain why this frigoripetal variation should have actually produced its uncus, longer tegumen and more broad and indented terminal process, when exactly the opposite effects are to be seen in (i) *M. ambigua* Ménétriés comparing its races of the south with those of the north of its habitat, or (ii) *M. parthenie* (Borkhausen) = (*aurelia* Nickerl) and *M. parthenoides* Keferstein with their respective glacial representatives *M. asteria* Freyer and *M. varia* Herrich-Schäffer. No such general cause as a climatic one can reasonably be called upon to account fundamentally for the existence of certain variations, although they are seen to repeat themselves in most species of a given group of organisms. Their determining factors can only be sought for in the constituents of the organism itself and their existence must be considered a necessary result of a comparatively spontaneous transformation, which external causes, such as climatic ones, can accelerate or retard but which are bound to take place, sooner or later, in all closely related branches in more or less the same way. That is why in the butterflies dealt with here, which exhibit many closely related collateral branches, one is confronted with considerable difficulty in determining direct relationship and descent as distinguished from collateral resemblances.

I have found, on examining their genitalia, that some races, hitherto attributed to *M. athalia* (Rottemburg), belong clearly to *M. ambigua* Ménétriés; their facies to the naked eye and their genitalia look somewhat intermediate between the two, but I do not believe that anything like the transitions which exist in Europe between *M. athalia* (Rottemburg) and its exerge *helvetica* Rühl will ever be found. Further, as *helvetica* Rühl occurs with *M. ambigua* Ménétriés in Ussuri, as will presently be seen, one can safely consider the latter a distinct species, with frigoripetal variations recalling to a certain extent the features of *M. athalia* (Rottemburg) in the extreme northern parts of its range.

(i) *M. AMBIGUA* Ménétriés race *NIPHONA* Butler.

Pl. 1, fig. 4 ♂; Genitalia pl. 10, fig. 255; (*mandschurica* Fixsen) pl. 1, fig. 5 ♂; Genitalia pl. 10, fig. 256 (same specimen as that illustrated on fig. 5 above); (*bathilda* Frühstorfer) pl. 8, figs. 207 ♂ (type), 208 ♂ (paratype).

Melitaea niphona Butler, 1878, *Cist. ent.* **2** : 281; *Melitaea mandschurica* Fixsen, 1887, *in* Romanoff, *Mém. Lép.* **3** : 302; *Melitaea athalia bathilda* Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 179; *Melitaea athalia* Rottemburg var. *sutschana* Reverdin, 1922, *Bull. Soc. lép. Genève* **5** : 28, fig. 1.

Race *niphona* Butler is the most southern and eastern race, being larger than the more northern and western ones and having the thinnest black pattern, although in some localities individuals with a much heavier pattern than usual do occur. Leech (1893, *Butt. China Japan Corea* (2), pl. 24, fig. 7) figured the "type," which is preserved in the British Museum. It is a female from Tokyo.

The names *mandschurica* Fixsen, *bathilda* Frühstorfer, and *sutschana* Reverdin have all been given to the Amurland population of *M. ambigua* Ménétriés, which does not differ from race *niphona* Butler from Japan, until about the northern latitude of the central Amur, beyond which it is replaced by the smaller race *ambigua* Ménétriés and to the west by race *kenteana* Seitz. All these three names, curiously enough, have been given in absolutely inadequate ways: Fixsen, on erecting *mandschurica* Fixsen, knew nothing of the existence of race *niphona* Butler. Frühstorfer thought that *mandschurica* Fixsen was a synonym of *latefascia* Fixsen from Corea, and said that he had received his specimens under the latter name, but he added that he found them quite like race *niphona* Butler on the upperside.

The few words of description which Frühstorfer gave in regard to the underside of *bathilda* Frühstorfer do not convey any difference. I figure the specimen of *bathilda* Frühstorfer, labelled "type" (no locality) in the Frühstorfer collection and also one of his paratypes received from central Amur from Radde.

Reverdin merely published the name of *sutschana* Reverdin, because this name appeared on the label of a specimen the genitalia of which he illustrated.

(ii) *M. AMBIGUA* Ménétriés race (?) *NOSSIS* Frühstorfer.

Pl. 8, fig. 209 ♂ (type).

Melitaea athalia nossis Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 180.

The insect named *nossis* by Frühstorfer is an unfortunately vague quantity: the "type," which I figure, and a few paratypes were obtained at Nagasaki by its author, who seems to have had reason to suppose, with marks of interrogation, that their place of origin was either that same Kiushiu island or one of the northern Liu Kiu islands. I cannot say that they seem to me to differ from some specimens from the rest of Japan dealt with above. Frühstorfer considered them smaller and more heavily marked with black above, and laid particular stress on the large size of the white spaces of the hind-wing underside.

(iii) *M. AMBIGUA* Ménétriés race *SACHALINENSIS* Matsumura.

Melitaea athalia sachalinensis Matsumura, 1925, *J. Coll. Agric. Hokkaido imp. Univ.* **15** : 99, pl. 8, fig. 2 ♀.

This race was described from a specimen taken at Rikovskoie in the north of the Sakhalin Island, and is described as being closely related to nominotypical *ambigua* Ménétriés, and as somewhat recalling *M. protomedia* Ménétriés, but with

rounder wings and thinner markings, whilst the hind-wings are said to exhibit three rows of reddish-yellow spots, the inner one of which is indistinct.

(iv) *M. AMBIGUA* Ménétriés race *AMBIGUA* Ménétriés.

Pl. 1, figs. 6, 7, 9 ♂, 8 ♀; Genitalia pl. 10, fig. 257 (same specimen as that illustrated on fig. 7).

This is the small northern race which replaces race *niphona* Butler at the mouth of the Amur river. It was described from Djai and I have specimens from Nikolaievsk collected by Graeser, and from Seja, which agree most exactly with Ménétriés's figure. The whole underside pattern and particularly the large size of the premarginal russet spots recall race *niphona* Butler perfectly and sustain the evidence afforded by the genital armature. The males have on the upperside a rather thin pattern, particularly on the disc of the fore-wing, where the three bands are often even partly obliterated. The deep black suffusion on the hind-wings, especially between the cell and the hind margin, which is to be seen in Ménétriés's figure, occurs only rarely in race *niphona* Butler. Some females are very melanistic, the bands being thick and the whole basal half of all the wings being covered by a thick black patch. It is surprising that Staudinger (1892, *in* Romanoff, *Mém. Lép.* **6** : 186) should have stated that examples of *M. athalia* (Rottemburg), collected by Graeser at the mouth of the Amur, " agree fully with European specimens " and that *ambigua* Ménétriés was nothing but a female aberration. This name according to Staudinger should therefore be withdrawn. I trust, however, that I have on the contrary now defined the status of the insect so named most exactly and have shown the need for the retention of this name.

(v) *M. AMBIGUA* Ménétriés race *KENTEANA* Seitz.

Pl. 1, fig. 12 ♂; pl. 8, figs. 213 ♂, 214 ♀; pl. 1, figs. 10 ♂ (trans ad *ambigua* Ménétriés), 11 ♂ (form or race *crassepicta* Verity); Genitalia pl. 10, figs. 258 (same specimen as that illustrated on fig. 10), 259 (same specimen as that illustrated on fig. 213), 260 (same specimen as that illustrated on fig. 11).

Melitaea athalia (Rottemburg) var. *kenteana* (Staudinger MS.) Seitz, 1909, *Grossschmett. Erde* **1** : 222, pl. 67, fig. A 5 ♀.

Staudinger described this race in his paper on the butterflies of the Kentei Mountains (1892, *Deuts. ent. Z.* " *Iris* " **5** : 326), but he did not give it a name. He distributed it, however, among various collections under the name *kenteana*, as noted by Heyne (1893, *in* Rühl, *Pal. Grossschmett.* **1** : 40 *nota*). The latter was, however, unable to give any description of it, since he was unacquainted with it in nature. Seitz mentioned it in very much the same way, simply stating that " it is a somewhat doubtful form from the Kentei," but, as shown above, he gave a figure of it and thereby conferred a nomenclatorial status on the name and became its author. This race, as represented by Seitz's figure and by specimens taken in the Transbaikal province, much farther north than the Kentei range, which I have determined by the genitalia to be referable to *M. ambigua* Ménétriés, can now at last be satisfactorily defined. This race is very similar to nominotypical *ambigua* Ménétriés and is indeed identical with it on the underside by reason of its *niphona*-like aspect, but is characterised by its larger average size and by the heavier black pattern of the upperside. There is no possibility of drawing a sharp line between these two insects, and they are

evidently only somations of a single race. I figure (Pl. 1, fig. 10) a male in my collection from Sobolino in the Transbaikal province, which is transitional to race *ambigua* Ménétriés, but is characterised by a thicker pattern, a duller fulvous tone, and larger size, such as is seen more often in race *kenteana* Seitz than in race *ambigua* Ménétriés from the lower Amur.

Another couple (Pl. 8, figs. 213–214) in the Heyne collection, labelled "*kenteana*," also from the Transbaikal, represents a degree farther from the typical figure by reason of the thickness of the black pattern. There is a male with still broader marginal and premarginal bands, from the same region, the exact locality of which is illegible, in the collection of the Hamburgisches Zoologisches Museum, very kindly sent to me on loan and of which I figure the underside (Pl. 1, fig. 12). The culminating degree of the thickening of all the bands is shown by a male labelled "Altai," sent to me by the British Museum, which belonged first to Grum-Grshimailo and later to Elwes. The latter evidently mixed it up with his specimens of *M. britomartis* Assmann, for he did not record *M. athalia* (Rottemburg) in his paper on the butterflies of those mountains. I figure (Pl. 1, fig. 11) this interesting example, as well as its genital armature (Pl. 10, fig. 260), which proves that it is referable to *M. ambigua* Ménétriés, which thus occurs in an unexpectedly western locality. Its underside does not differ from that of race *kenteana* Seitz, except that the black markings are sharper. I think that this extremely dark form of *M. ambigua* Ménétriés is well worth distinguishing by the name of **Melitaea ambigua** Ménétriés, form **crassepicta** form. nov. The type specimen of this form, which is in the Verity collection, is a male, and its locality is given on the label as "Altai." It remains to be seen whether this form is racially constant or prevalent in the Altai or elsewhere, or whether it is only an extreme individual form of race *kenteana* Seitz. The tinge of the fulvous is deeper and redder than is usual in the last-named race.

(vi) **M. AMBIGUA** Ménétriés race **SAYANSKALPINA** race n.

Pl. 1, figs. 13, 14 ♂, 15 ♀; Genitalia pl. 10, figs. 261 (same specimen as that illustrated on fig. 14), 262 (same specimen as that illustrated on fig. 13).

Part of the type series of this high-elevation race was taken in the Eastern Sayansk Mountains, south of Lake Baikal (Chulugaisha, 2600 m., above Mondy), the other part having been taken from the Sayansk Mountains in Turan (Turkinsk White Mts., 2000 m.). The characteristic of this alpine race is the extent of the black suffusion, which covers the basal part of all the wings on the upperside of both sexes. The transverse bands in themselves are not particularly thick and in some individuals, some, and especially the premarginal ones of the fore-wing, are quite as thin as in race *ambigua* Ménétriés and are somewhat effaced, so that in some specimens the outer part of the wing exhibits broad fulvous spaces contrasting with the darkened basal ones. A few examples are very similar to Seitz's figure of race *kenteana* Seitz, except that they have a darker base. Sexual dimorphism is much more prominent in this race than in the others, as is usual in alpine races. The black suffusion is, in the female, not as deep in tone as in the male, but it invades a still greater area, usually only leaving one or two rows of small fulvous spaces (even those being indistinct) on the hind-wing, and two or three rows on the fore-wing; the fulvous is also very pale and whitish in this sex.

The specimen selected as the holotype of this race is a female, preserved in the Verity collection. Its locality is given on its label as "Chulugaisha, 2600 m."

3. *MELITAEA DEIONE* (Geyer).

Geyer, [1828]–[1832] *in* Hübner, *Samml. europ. Schmett.* pl. Pap. 192, figs. 947, 948 ♂, 949, 950 ♀; *Melitaea deione* Geyer Gen. II *dejonella* Verity, 1930, *Ent. Rec.* **42** : 134; *Melitaea deione* Geyer race *praestantior* Verity, 1932, *Ent. Rec.* **44** : 141.

I have already indicated (p. 593) the main features of the genital armature which, as Reverdin showed (1927, *Bull. Soc. lép. Genève* **5** : 167), distinguish *M. deione* (Geyer) from allied species. It is true that the genitalia of this species had previously been figured by Sheldon (1916, *Ent. Rec.* **28** : 263, pl. 4, figs. 3, 4), but neither these figures nor the few words of description given by Sheldon illustrated these processes at all fully, the differences which he noted between the genitalia of nominotypical *M. deione* (Geyer) and those of race *berisalii* Rühl being purely individual. I should add that I have not detected such differences in any specimens which I have examined; nor did Hormuzaki do so in the case of a single specimen in his collection.

I discussed at length in 1930 (Verity, 1930, *Ent. Rec.* **42** : 133) the most likely position of *M. deione* (Geyer) in the *athalia* group, and I showed how this species exactly agrees with a general rule which one can establish in a large number of butterflies, beginning by the other Melitaeid species *Euphydryas desfontainii* (Godart), which stands to *E. aurinia* (Rottemburg) in very much the same way as does *M. deione* (Geyer) to *M. athalia* (Rottemburg), while race *beckeri* Lederer (= *iberica* Oberthür) of *Euphydryas aurinia* (Rottemburg) affords a certain analogy with exerge *helvetica* Rühl (= *pseudathalia* Reverdin) of *M. athalia* (Rottemburg) except for its very much more restricted, extreme western, habitat at the present day. They are the branches which have been less modified by frigoripetal variation, and have been preserved in the extreme western part of their habitat by the milder Atlantic climate during the glacial periods, *M. deione* (Geyer) becoming slightly modified only in the races *rondoui* Oberthür and *berisalii* Rühl, when it extended northward.

(i) *M. DEIONE* Geyer race *ROSINAE* Rebel.

Melitaea dejone [sic] *rosinae* Rebel, 1911, *Ann. nat. Mus. Wien* **24** : 375–377, pl. 11, figs. 1 b, e ♂, 1 c, f ♀, a, d (genitalia).

This race was described from specimens reared from larvae collected on *Antirrhinum* at Cintra, near Lisbon, which emerged in the first half of June. Rebel argued most emphatically that it could only be referable to *M. deione* (Geyer), because of the palpi, which, viewed from above, are of a bright russet colour, whereas in all specimens of *M. athalia* (Rottemburg) they are blackish. He also compared minutely the male genital armature of *rosinae* Rebel with that of *M. athalia* (Rottemburg). In those days, however, nothing was known of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) of the latter species, so that in this respect the features which he described agree quite as well with the latter as with *M. deione* (Geyer). Fortunately his outline drawing of the genitalia shows clearly that *rosinae* Rebel belongs to *M. deione* (Geyer), this being seen chiefly by the row of pronounced teeth all along the hind edge of the terminal process of the valves as shown, for instance, in the figures (Pl. 10, figs. 265, 266) which I give of *M. deione* (Geyer). This character and the palpi prove beyond doubt that Querci was certainly wrong in applying the name *rosinae* Rebel (1932, *Trab. Mus. Sec. nat. Barcelona* **14** : 127) to the race of exerge *helvetica* Rühl found by him in the Serra de Estrela. Moreover the figures of *rosinae* Rebel given by Rebel show clearly that it is neither the second (as believed by Querci),

nor the first, generation of *helvetica* Rühl. In size the specimens figured by Rebel are much larger than the second generation of *helvetica* Rühl ever is, their fore-wing measuring 20 mm. from root to apex as compared with 16–18 mm., while they are smaller than the first generation, in which the fore-wing averages 22 mm. in length. The upperside black pattern is thicker and more evenly distributed over the whole of the wings than in either generation of *helvetica* Rühl. This is particularly striking in connection with the large S-shaped band and the marginal band. On the underside the premarginal white lunules are correspondingly much smaller on both fore- and hind-wing, and on the fore-wing the one between the third median and the first cubital nervure is about level with the others, instead of projecting farther inwards, as is usual in either exerge *helvetica* Rühl or exerge *athalia* (Rottemburg) of *M. athalia* (Rottemburg). On the whole, one can state that *rosinae* Rebel is perfectly similar to many individuals of race *rondoui* Oberthür, to which it stands very near.

(ii) *M. DEIONE* Geyer race (?) *PHILOMELA* Frühstorfer.

Melitaea deione philomela Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (6) : 12.

Frühstorfer gave " Portugal " as the locality for this race, but he gave no indication of the place in that country where the type specimen was captured. He described this race in a way which sounds very similar indeed to that of *rosinae* Rebel. Its author was well acquainted with the aspect of the palpi of *M. deione* (Geyer), so that, here again, it seems as though one should examine his typical specimens in the Turati collection of the Zurich Museum, before applying that name to *helvetica* Rühl, as suggested by Querci.

(iii) *M. DEIONE* Geyer race *NITIDA* Oberthür.

Melitaea deione race *nitida* Oberthür, 1909, *Ét. Lép. comp.* **3** : 253–254.

This is the largest and handsomest race of the species, and has remained in Algeria and in Andalusia which was connected formerly with Africa. Oberthür stated that his types came from Sebdou and Oranie in Algeria. Oberthür later (1915, *ibid.* **10** : 105–107, pl. 282, figs. 2305, 2306), when figuring this race, remarked that the races of Algeria and Andalusia could be united under the same name. Ribbe, in his catalogue of the Lepidoptera of Andalusia, maintained most positively that no race of *M. athalia* (Rottemburg) occurred in southern Spain and that *magna* Seitz, described as a form of that species, was in fact referable to *M. deione* (Geyer) and fell therefore as a synonym of *nevadensis* Oberthür. The latter was at first referred to *M. deione* (Geyer) by Oberthür, who, however, subsequently declared that he had come to the conviction that *nevadensis* Oberthür was referable to *M. athalia* (Rottemburg). In 1910 Oberthür published figures of two further specimens (*Ét. Lép. comp.* **4** : 672, pl. 45, figs. 355–358) which certainly give the impression that Oberthür was right and that Ribbe was wrong. Querci also considered (1932, *Trab. Mus. Sec. nat. Barcelona* **14** : 129) that *nevadensis* Oberthür was referable to exerge *helvetica* Rühl of *M. athalia* (Rottemburg). It remains to be seen whether *magna* Seitz, too, is the lowland race of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) of *M. athalia* (Rottemburg), the remarkable resemblance of the former to *M. deione* (Geyer) not having been sufficiently recognised. To my mind, Seitz's figure of *magna* Seitz stands much closer to *nevadensis* Oberthür than to Oberthür's figures of the true race of *M. deione* (Geyer) which he named *nitida* Oberthür.

(iv) *M. DEIONE* Geyer race (?) *ESPUNAENSIS* Korb.

Melitaea deione Geyer var. *espunaensis* Korb, 1915, *Mitt. münchn. ent. Ges.* **6** : 36.

This name, which has hitherto been completely overlooked, was given by Korb to a very large race from the Sierra d'Espuna (Province of Murcia), described as having very variable females with a broad light yellow central area and strongly curved and dentated transverse lines, so that it is said to differ greatly from the race of the Sierra Alfacar of Andalusia.

Whether the insect which Korb had before him was, in reality, a form of *M. deione* (Geyer) or a form of exerge *helvetica* Rühl of *M. athalia* (Rottemburg) it is impossible to say from his description. This race is here provisionally retained under the first-named species.

(v) *M. DEIONE* (Geyer) race *DEIONE* (Geyer).

Pl. 1, fig. 16 ♂ (form *praestantior* Verity); Genitalia pl. 10, fig. 263.

The nominotypical race of *M. deione* (Geyer) was, according to Duponchel, described from specimens taken in Aix-en-Provence. This is the most widespread form of this species and occurs from southern France to the Castille, where Querci found it flying in company with *M. athalia* (Rottemburg) exerge *helvetica* Rühl and with *M. parthenoides* Keferstein, from which it was quite recognisable even in the field by its quick flight and bright orange colour. This race is normally larger, more boldly marked and brightly coloured than the specimen figured originally by Geyer, which was presumably obtained from a particularly dry locality.

Whether the form figured by Geyer is locally constant or not remains to be seen, but I have thought it advisable to distinguish the other form by the name of *praestantior* Verity (*Melitaea deione* Geyer race *praestantior* Verity, 1932, *Ent. Rec.* **44** : 141), taking as typical a series of specimens from La Sainte Baume (Department of the Var), collected on 20th May.

To the much smaller second generation of nominotypical *deione* (Geyer) I gave the name *dejonella* Verity (*Melitaea deione* Geyer gen. II *dejonella* Verity, 1930, *Ent. Rec.* **42** : 134) from specimens taken at Saint Zacharie, also in the Department of the Var, which were collected on 8th August.

(vi) *M. DEIONE* (Geyer) race *VESUBIANA* Verity.

Pl. 1, fig. 17 ♂; pl. 8, fig. 206 ♀.

Melitaea deione Geyer race *vesubiana* Verity, 1932, *Ent. Rec.* **44** : 141.

This is a decidedly distinct mountain race from the Maritime Alps, occurring at St. Martin-de-Vésubie (June and mid-August). It is larger than the form *praestantior* Verity of nominotypical *M. deione* (Geyer), more richly coloured (more variegated in the female sex) and more prominently marked, so that in this respect it points to races *signata* Sagarra and *rondoui* Oberthür. I now figure a female taken at Tenda from the Frühstorfer collection which shows that this race exists within the political boundary of Italy although Tenda is geographically on the western watershed. I have given the name *vesubiella* Verity (*Melitaea deione* Geyer race *vesubiana* Verity form *vesubiella* Verity 1932, *Ent. Rec.* **44** : 141) to the second generation of this race.

(vii) *M. DEIONE* (Geyer) race *PHAISANA* Frühstorfer.

Pl. 1, fig. 19 ♂; pl. 8, figs. 204 ♂, 205 ♀ (holotype and allotype of *rafaëla* Frühstorfer); Genitalia pl. 10, fig. 265.

Melitaea deione phaisana Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 11; *Melitaea deione rafaëla* Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (6) : 11; *Melitaea deione felkeli* Stauder, 1922, *Ent. Anz.* **2** : 133.

This is a very distinct race, the type of which was taken in the Upper Adige (S. Tyrol). It is characterised by its small size and by the accentuated black pattern, which is especially characteristic on the underside in contrast to that of race *vesubiana* Verity. How Frühstorfer could say that all the underside parts, which are whitish in nominotypical *M. deione* (Geyer), are yellow in race *phaisana* Frühstorfer, though not as saturated as in race *berisalii* Rühl, is quite incomprehensible. In all the specimens which I possess there is only a slight increase in the intensity of the yellow which goes with the more saturated colouring in general of this race. Frühstorfer informed me (in a letter dated 15th September, 1920) that race *phaisana* Frühstorfer had been discovered by Prof. Stange, near "Clausen."

A very unfortunate description is that given by Frühstorfer to *rafaëla* Frühstorfer from specimens simply labelled "Northern Italy." This alleged race is said to be characterised by the whitish colour of "all the components of the medium zone of the hind-wing" on the underside of both sexes, besides the more evenly marked upperside pattern. I figure the pair in his collection, which he stated were the "types," whilst others in the Zurich Museum (from the old G. F. Turati collection) were mentioned as belonging also to *rafaëla* Frühstorfer. To my mind the former are identical with *phaisana* Frühstorfer, described three years previously.

In my opinion also it is impossible to regard the insect named *felkeli* by Stauder (type from the Eisachtal) as other than a synonym of *phaisana* Frühstorfer.

(viii) *M. DEIONE* (Geyer) race *TESSINORUM* Frühstorfer.

Melitaea deione tessinorum Frühstorfer, 1918, *Soc. ent.* **33** : 22.

This race, the type of which was taken in the Ticino at Biasca (at the end of July), is said to be more heavily marked with black than nominotypical *M. deione* (Geyer) and to constitute an approach to race *berisalii* Rühl in all respects and in both sexes (especially the male).

(ix) *M. DEIONE* (Geyer) race *SIGNATA* Sagarra.

Melitaea deione Geyer race *signata* Sagarra, 1926, *Butll. Inst. Catal.* (2) **6** : 131.

This race was described from material collected by Querci at Seva and Montseny in northern Catalonia. It is, according to Querci's observations, quite constant in this region, but it occurs also elsewhere (especially in rainy years), *e.g.*, in Castile (on the Serrania de Cuenca in the damp year 1928) and in Aragon (*e.g.*, at Albarracin). This race is characterised by the fact that the black markings on the upperside are thicker than is ever the case in nominotypical *M. deione* (Geyer) from the south of France.

(x) *M. DEIONE* (Geyer) race *RONDOUI* Oberthür.

Pl. 1, fig. 18 ♂; Genitalia pl. 10, fig. 264 (same specimen as that illustrated on fig. 18 above).

Melitaea deione Geyer race *rondoui* Oberthür, 1909, *Ét. Lép. comp.* **3** : 253–254.

This race, which was described from Gèdre in the Department of the Hautes-Pyrénées, represents a still further stage in the extension of the black pattern on the upperside. The unusual extent of this feature in the specimen which I figure goes so far as to make it resemble almost exactly a specimen of race *berisalii* Rühl. If it were not for the fact that its underside is highly characteristic of nominotypical *deione* (Geyer), I should have thought that it might have been referable to exerge *helvetica* Rühl of *M. athalia* (Rottemburg), owing to the terminal processes of the genitalia being more like those of that species than those of *M. deione* (Geyer). It appears to be a rather unstable race produced by high mountain conditions.

(xi) *M. DEIONE* (Geyer) race *BERISALII* Rühl.

Pl. 1, fig. 20 ♂; Genitalia pl. 10, fig. 266 (same specimen as that illustrated on fig. 20 above).

Melitaea athalia Rottemburg ab. *berisalii* Rühl, 1891, *Soc. ent.* **5** : 149; *Melitaea berisalensis* (olim *berisali* [sic] Rühl) Favre & Wullschlegel, 1897, *Mitt. schweiz. ent. Ges.* **10** : 34 (translation in 1899, *Ent. Rec.* **11** : 315).

This race occurs in the hottest spots in the lowlands of the Canton Valais from Sierre to Martigny (and not at Berisal, as its author through an oversight supposed). It is the most highly modified of all the races of this species—as is evident—in the frigoripetal direction of variation but it is in no way so distinct as to justify the doubt that it may be a different species. The differences exhibited by the genitalia to which Sheldon drew attention in the specimens he figured in the *Entomologist's Record*, 1916 (Sheldon, 1916, *Ent. Rec.* **28** : 263, pl. 4, figs. 5, 6), are casual and individual differences only, which I have not met with in my specimens. The other differences in the general facies all derive from a general increase in the extent of the black pattern, especially along the outer edge, reached occasionally also by *rondoui* Oberthür as noted above.

Higgins has recorded a specimen of race *berisalii* Rühl taken at Oulx, in the Val Susa, and has subsequently confirmed to me *in litt.* the accuracy of this record.

I have given the name *berisalella* Verity to the second generation of this race (*Melitaea deione* Geyer race *berisalii* Rühl, Gen. II *berisalella* Verity) (1935, *Ent. Rec.* **47** (Suppl.) : (76)).

4. *MELITAEA ATHALIA* (Rottemburg).

Papilio athalia Rottemburg, 1775, *Naturforscher* **6** : 5.

The apparently very natural specific unit with definite limits obtained by collecting together all the forms usually known as *M. athalia* (Rottemburg) which have been shown to blend with one another, may well be said to afford here one of the broadest ranges of structural variation known in any species of butterfly. The general aspect of this species to the naked eye, as compared with those of other Melitaeid species, such as *M. didyma* (Esper) or *Euphydryas*

aurinia (Rottemburg), would scarcely have led one to suspect such diversity of structure, notwithstanding the conspicuous variations of the extent of the black pattern. The examination of the male genital armature has, however, revealed differences which one would not have thought possible within the limits of a single species. In point of fact some entomologists still do not believe such differences possible and prefer to refer some of the races of *M. athalia* (Rottemburg) to other species. As already shown, this has been done by Hormuzaki and Agenjo in connection with *helvetica* Rühl; the former, as will be shown later, had at the time also confused some races of *M. athalia* (Rottemburg) with race *dictynnoides* Hormuzaki of *M. britomartis* Assmann. Reverdin's original conclusion (although accompanied by strong doubts) was that *M. pseudathalia* (Reverdin) (i.e. *helvetica* Rühl) seemed to be a distinct species. This conclusion was very much more reasonable and might still be discussed in the light of the various opinions concerning the specific standard; but, to my mind, when two groups intercross and blend in nature to the extent which *helvetica* Rühl and *M. athalia* (Rottemburg) have been found to do all along the points where their ranges meet and where they have been found together, whilst those ranges do not overlap to any broad extent, this is in fact a phenomenon which cannot be considered equivalent to the more usual one of species closely related to each other but living and spreading together, without ever intercrossing, such as exhibited by *Erebia ligea* (Linnaeus) and *E. euryale* (Esper) and by *Hipparchia fagi* (Scopoli) and *H. alcyone* ([Schiffermüller & Denis]). It is for this reason that I erected the term of " exerge," which I now feel more convinced than ever was necessary in order to provide a term by which to designate the particular kind of relationship of which the two species of *Melitaea* Fabricius here in question are a typical case. I am, moreover, equally convinced that the terms " subspecies " or " race," according to their usual meaning and use, would not be correct in this case; for they refer to another phenomenon, where branches, different from each other because they bear distinctive features in an hereditary way, characterise the different subspecies or races by their frequency, but fertility between them is fully efficient and those various features occur, more or less everywhere, in a certain number of individuals, according to Mendelian laws. I, therefore, treat *helvetica* Rühl and the true *M. athalia* (Rottemburg) as two distinct " exerges " of the species *M. athalia* (Rottemburg). I do not, however, think that one can apply the same term to a third form produced by the last-named exerge, which is to all appearances intermediate between it and exerge *helvetica* Rühl. The characteristic of this intermediate group of races is that the two processes of the uncus are straight or nearly straight up to the end, and thin (not thicker at the base and broadly curved towards each other towards the apex as in the exerge *athalia* (Rottemburg)). These processes are usually long and are in fact often even longer than in most of the last-named exerge, but they are no less often quite short, both individually and locally, pointing, apparently, to the tiny processes exhibited by the less highly characterised races of exerge *helvetica* Rühl, which occur on the northern limits of the habitat of that exerge. What seems to sustain this view very strongly is (a) that a decided transition from exerge *helvetica* Rühl to true *M. athalia* (Rottemburg) is clearly shown by the shape of the terminal process of the valves and (b) that as a rule those races of *M. athalia* (Rottemburg) with the uncus just described also have this latter process, with an aspect strongly recalling exerge *helvetica* Rühl: thin, long, and with only two or three points or spines, but none of the more or less broad and very much indented plateau, as Reverdin calls it, of its anterior edge, as seen in true *M. athalia* (Rottemburg).

The form of *M. athalia* (Rottemburg) with a very long slender uncus was first described and figured from the Bukowina by Hormuzaki (1911, *Z. wiss. InsBiol.* **7** : 261). Its discovery was unfortunately mixed up with the unhappy history of the name *dictynnoides* Hormuzaki, an insect found in the Bukowina also; for Hormuzaki concluded that the presence of this structure was a peculiarity of this region and one of the characteristics of the last-named insect. This mistake was due to his having originally confused small specimens of *M. athalia* (Rottemburg) with *M. britomartis* Assmann, because they both were highly melanistic and on the upperside somewhat recalled in aspect *M. diamina* (Lang) (= *dictynna* Esper). In his first description of this insect (1898, *Deuts. ent. Z.* "*Iris*" **11** : 1), Hormuzaki concluded with Staudinger that these specimens belonged to a variety of *M. aurelia* Nickerl (*i.e.* of *M. parthenie* (Borkhausen)). In 1911, after having examined the genitalia and found that they all had an uncus, Hormuzaki concluded that this insect should be transferred to *M. athalia* (Rottemburg). It was only in 1934, after having seen first Suschkin's paper, in which were figured the genitalia of *M. britomartis* Assmann, and then my paper published in 1930 (*Ent. Rec.* **42**), where I established the vast distribution of this species, that Hormuzaki took up this question once more and concluded that *dictynnoides* Hormuzaki was, in reality, a melanic race of *M. britomartis* Assmann, exactly similar to race *seminigra* Seitz from Asia, and that some small, equally melanic specimens of *M. athalia* (Rottemburg) found with it had given rise to the erroneous belief that the long, slender uncus was a feature of it. One of the examples of the last-named insect found its way to Sheldon, who figured its genitalia (Sheldon, 1916, *Ent. Rec.* **28** : 262, pl. 3, figs. 3, 4), and noted that it was referable to *M. athalia* (Rottemburg). Frühstorfer was misled, also, by Hormuzaki's paper of 1911 and applied the name *dictynnoides* Hormuzaki to the widespread, very dark race of the northern Balkans of this species, to which I now consequently give a name of its own. I figure specimens from various localities, showing how the slender uncus, associated with a terminal process, obviously transitional to that of exerge *helvetica* Rühl, is quite a feature of a great many forms of *M. athalia* (Rottemburg) of that region. I shall show presently that what may be called, on the whole, the next transitional grade of variation in the *helvetica* direction is to be found in northern Italy. Reverdin has also illustrated similar forms from the Soleure district of western Switzerland, and transitional individuals of the same kind exist, together with a great many examples of true exerge *athalia* (Rottemburg) and a few examples of exerge *helvetica* Rühl, as far west as the Gironde, from which locality I figure two specimens from Reverdin's preparations kindly sent me on loan by the Geneva Museum. From the opposite direction, *i.e.*, from the East, I figure two specimens from Asia Minor, in which the terminal process shows a striking resemblance to exerge *helvetica* Rühl, which, however, does not exist at all in that region.

If one is to make an attempt to interpret these intermediate forms, one must consider first whether they can all be regarded as secondary forms produced by the interbreeding of true exerge *athalia* (Rottemburg) with exerge *helvetica* Rühl, such as Reverdin thought was the case as regards his specimens from the Soleure district of Switzerland (which I have named race *synexergica* Verity on this account), or such as certainly seems to be the case in the Gironde and very possibly in the Ischl region of Austria, where exerge *helvetica* Rühl has actually been found together with true exerge *athalia* (Rottemburg), as will be seen when dealing with these forms.

Let it be noted in this connection that the discovery of *helvetica* Rühl on the Pacific coast strongly suggests that both exerge *athalia* (Rottemburg) and

helvetica Rühl have spread from that region, like most widespread palaearctic species, although exerge *helvetica* Rühl has become extinct, so far as is known, in the whole of the vast region from Ussuria to Austria and Italy. In all probability they both derived originally from the same tropical species of the genus *Phyciodes* Hübner, and have been transformed together in a parallel way by the advent of temperate climates, as noted in discussing the origins of *M. ambigua* Ménétriés and of *M. athalia* (Rottemburg) taken as a whole. The important fact must be borne in mind, also, that in the extreme west there exists a species, *M. deione* (Geyer), of which no trace at all has remained in Asia, although it must have been derived from the same source as the others, if the theory of parallelism here suggested is correct. This paradox, however, has been found to exist in a great many species, and in the western races of many widespread ones. It seems, therefore, that one must be satisfied in assuming that forms even of a particularly primitive kind have been preserved in the West which have disappeared in the East, although they may resemble Nearctic forms more than do the corresponding Eastern forms to-day. One is, therefore, justified in suspecting that the intermediate forms between exerge *helvetica* Rühl and exerge *athalia* (Rottemburg) now being discussed in particular, or at least those of Asia Minor and eastern Europe, where these two exerges do not exist in their pure forms (or at least the exerge *helvetica* Rühl is absent), might well resemble most nearly the primary ancestral form from which both have been derived and which in some branches has not been transformed, but has preserved its intermediate features to the present day. This view, namely that this form may be less highly specialised than either of these two exerges, seems sustained by the lesser difference referred to above between its genitalia and those of the closely allied branches of *M. ambigua* Ménétriés. This view is supported further by the much greater variability of the general aspect of this form, which often recalls other allied species, *e.g. M. parthenoides* Keferstein, to an extraordinary extent, and *M. diamina* (Lang) (= *dictynna* Esper) to a lesser degree, not to speak of certain features of the underside of race *rondoui* Oberthür and other races of *M. deione* (Geyer), which even exerge *helvetica* Rühl does not reproduce, although it resembles the latter very much in other respects, whereas these features are strikingly obvious in races *anatolica* Wagner, *dejonides* Wagner, *lachares* Frühstorfer, etc. of *M. athalia* (Rottemburg), in which the uncus is long and slender.

The separation of exerge *helvetica* Rühl from the most highly specialised nominotypical exerge *athalia* (Rottemburg) in past epochs, as well as in the present one, according to a complete series of transitional forms, which still connect them in certain regions, appears to be a repetition on a lower scale—and precisely on the exergic one—of the phenomenon which, in very much more ancient times, had produced on the higher specific scale, the separation of *M. deione* (Geyer) from *M. ambigua* Ménétriés.

It seems reasonable to believe that, in this case, as in a great many others, afforded by many species of butterfly, a group of races belonging to a third branch should have preserved to a certain extent its intermediate nature, its characters not having become as specialised and constant as in the two species just mentioned, and that it is exactly this form which has again undergone the same process, throwing out exerge *helvetica* Rühl. This repetition must have taken place in the same Polar continent, after a comparatively brief interval, as is shown by the discovery of exerge *helvetica* Rühl on the northern coast of the Pacific. Most of the remaining portions of this branch must, then, while in Siberia, have drifted gradually into the constitution and facies of what is now

exerge *athalia* (Rottemburg), under the stress of increasingly cold climates during the coldest periods of those times, which brought over from the Himalaya the mouflon and a large migration of plants and animals. This is shown by the fact that some representatives have remained in the mountains along that route and, among them, the race of *M. athalia* (Rottemburg) known from Armenia, and also *anatolica* Wagner, which still preserves constantly and to the highest degree both the ancestral type of genitalia and the general facies being dealt with, instead of having been transformed, as happened to the members of the northern branch.

When speaking of races *britanna* Verity and *parvahispanica* Verity (see pp. 645–646 below), which are the most highly specialised and, from the genitalia point of view, distinct from the form discussed above, it may be seen that they represent, according to all appearances, the culminating stage of the variation which occurred in the extreme West, and that they there survived the glacial periods of the Pleistocene in the coast region which then spread farther East and had the warm Gulf Stream nearer to it than at the present day. The intermediate ancestral form, including *anatolica* Wagner, passed these periods in the southern parts of Europe and in Asia Minor in the milder Mediterranean climate, and exerge *helvetica* Rühl of *M. athalia* (Rottemburg) and *M. deione* (Geyer) passed these periods in the regions of it which were the warmest, the latter particularly in Africa and Andalusia.

Bearing these facts and inferences in mind, one may conclude that the intermediate form of *M. athalia* (Rottemburg), the nature of which I am here trying to establish, is according to all probabilities made up of two elements. The first of these elements, which may be regarded as having a primary origin, consists precisely of the original stock, which has preserved the constitution which all branches had before part of them was transformed, the first to be so modified having become what is now exerge *helvetica* Rühl, the remainder at a later date having become what is now exerge *athalia* (Rottemburg) of *M. athalia* (Rottemburg) of western Europe. The other element, if of secondary origin, has been produced, so to say, regressively through the occurrence of interbreeding between pure strains of exerge *helvetica* Rühl and exerge *athalia* (Rottemburg), where the habitats of such strains met, when after the Glacial Periods they repopulated Europe by spreading from their places of refuge, in the Atlantic coastal region and in Siberia, in the case of exerge *athalia* (Rottemburg), and in the Mediterranean coast regions, in the case of exerge *helvetica* Rühl. This second type of intermediate form may be distinguished from the first type by the fact that with this type there are found also (in varying numbers) individuals of the two purer strains which have produced it and which evidently are still produced as well as the transitional ones. I deal at length with these " syn-exerges " in a special section where I define the regions where they exist, and which extend from western Austria, across Switzerland, to the Gironde (in France), and to the southern watershed of the Alps in Italy.

As regards the distribution of the primary intermediate form, I shall in the same way show in due course that it is proper to eastern central Europe as far as the Northern Balkans and the extreme north-east of Italy, and that it ranges from Finland to Asia Minor. This area suggests strongly that this may be the actual ancestral exerge of *M. athalia* (Rottemburg); or, in other words, that it is derived from the southern Miocenic exerge which from its places of refuge in the Balkans and Asia Minor spread northward after the Glacial Periods, by the Dnieper and the Vistula route, which has been shown to have been followed by the birch tree and by many plants and mammals. In the north it must

evidently have met the northern exerge, at that time spreading westward from Siberia across the belts of land which were then being formed between Asia and Europe north of the Caspian Sea, owing to the drying up of the sea-channel, which until then had connected the latter with the Arctic Sea. As a matter of fact, in a series of *M. athalia* (Rottemburg) from Leningrad preserved in the Hamburgisches Zoologisches Museum, I observe that two very distinct extreme forms are represented. One is that with which I am dealing here; the other is a perfectly typical example of exerge *athalia* (Rottemburg).

The Miocene strain in question must, however, as noted above, have belonged to one of the colder periods of that epoch, such as brought the mouflon and other mountain species over from the Himalaya, and in fact, in Asia Minor *M. athalia* (Rottemburg) at the present time only occurs in the mountains. Curiously enough there is to-day no trace in that region of exerge *helvetica* Rühl, which is the exerge of *M. athalia* (Rottemburg) which corresponds to the typical Miocenic Central exerge of the majority of widespread species, as is plainly shown by its southern constitution and distribution in the northern part of the Mediterranean region, where it can withstand very hot and dry surroundings.

The still more thermotropic constitution of the Southern exerge does not exist in any present-day exerge of *M. athalia* (Rottemburg) and is replaced by the specifically distinct *M. deione* (Geyer) which occurs in Africa at the present time, but (like exerge *helvetica* Rühl) not in Asia Minor.

I thus tabulate as follows the relationships between the components of the species of *Melitaea* Fabricius which I have just discussed, noting that, whether they have, or have not, been produced by phylogenetic successive bipartitions, they certainly exhibit at the present day successive twin groups, between which differentiation decreases regularly in degree, so that those groups decrease in rank accordingly. It is as though at each bipartition a smaller group was thrown out and the larger one then divided again, in more or less identical fashion, but on a lesser scale. This phenomenon is to be observed so often in the variation of butterflies that it seems to derive from some very general law. When it is not to be seen, it may be because some of the components have become extinct through natural selection. These successive bipartitions may be shown diagrammatically with reference to the male genital armature as follows :—

- *M. deione* (Geyer) : never any uncus
- *M. athalia* (Rottemburg)
  - *helvetica* Rühl
    - no uncus (southern group of races)
    - rudimentary uncus (northern group of races)
  - *athalia* (Rottemburg)
    - thin uncus (eastern Europe group of races discussed above)
    - thick uncus
      - long uncus (nomino-typical *athalia* (Rottemburg)
      - short uncus (*britanna* Verity, *parvahis-panica* Verity)

SECTION I.—Exerge *helvetica* Rühl (= *pseudathalia* Reverdin).[1]

The distinctive features of exerge *helvetica* Rühl were discovered in the male genital armature by Reverdin (1920, *Bull. Soc. ent. France* **1920** : 320), who considered them as indicating a species distinct from *M. athalia* (Rottemburg). This insect he named *Melitaea pseudathalia* Reverdin. It has, however, been

[1] For Section II, see p. 624.

subsequently noted that as a collective name this name must fall by reason of the existence of earlier names given to races which have now been shown to belong to that insect. The oldest of these names is *helvetica* Rühl given in Dec. 1888 to the high alpine race of the Grisons. That name has therefore in the last few years been adopted for this exerge by most authors. Beuret and Higgins have cast some doubt on the question whether the genital armature of the types of *helvetica* Rühl were of the *pseudathalia* type because in that part of Switzerland (*i.e.* the Engadine) these authors found that there frequently occur individuals transitional to exerge *athalia* (Rottemburg), in that they exhibit an uncus which may be fairly well developed in some individuals. Unfortunately, in the Rühl collection (now preserved in the R. Istituto di Entomologia Agraria in Florence) there only remains one female, so that no direct proof is obtainable regarding the structure of the original males. I have, however, been able to procure topotypes from Stalla, which is the locality explicitly mentioned, together with Bergün, in Rühl's original description; and the genitalia of these specimens have turned out to possess highly characterised features of *pseudathalia* Reverdin, apart from the rudimentary uncus, which is usually present in the northern part of the habitat of that insect. One is, therefore, fully justified in maintaining that the name *helvetica* Rühl is the correct name for this exerge. The distinctive features of this exerge as compared with exerge *athalia* (Rottemburg) and deemed by Reverdin to be, very likely, of specific value are (practically speaking) those afforded by the male genital armature alone. They can be summarised as follows: no uncus, or a rudimentary one in certain races; tegumen short and crescentic; lateral process or harpe of valves elbowed at one-third of its length, straight, or nearly so, beyond that sharp curve, and bearing spines all along its edge, nearly to the apex; terminal process thin, long, and bearing only two spines at the apex and usually a third one before them on the hind edge but otherwise not dentated.

Dr. Rocci is to be credited with having discovered (1932, *Mem. Soc. ent. ital.* **10** : 207; 1933, *ibid.* **11** : 141, figs. 3, 4) that exerge *helvetica* Rühl divides in Europe into (i) a southern group of races, which never exhibits any trace of an uncus and (ii) a northern one which usually exhibits a rudimentary one, developed to a greater or lesser extent, individually and locally, although the terminal and lateral processes of the valve in this group of races are usually quite characteristic of exerge *helvetica* Rühl and only occasionally point to those of exerge *athalia* (Rottemburg). These two groups cannot, however, be considered as equivalent entities. The northern group consists simply of several grades of transition between exerge *helvetica* Rühl and exerge *athalia* (Rottemburg), and blends on a broad scale with the group of the latter (discussed above) which exhibits a peculiar slender uncus. Reverdin himself, and more lately Rocci, Beuret (1923, *Mitt. schweiz. ent. Ges.* **15** : 424) and Higgins (1932, *Entomologist* **65** : 217–223) have recorded a large number of transitional specimens, in some of which the various genitalia characters of exerge *helvetica* Rühl and exerge *athalia* (Rottemburg) are completely mixed and in part substituted for each other. As already noted, the abundance of such cases in nature entirely destroys the essential feature of specific distinctness and cannot be accounted for by hybridisation proper. It is on this account that, although Beuret found differences also in the larva and the pupa, he also concluded that *helvetica* Rühl and *athalia* (Rottemburg) cannot be fully distinct species but are, probably, species, so to say, in the making.

I deem it advisable to record and to distinguish by a special name a form of exerge *helvetica* Rühl characterised by the peculiar form of genitalia which I

illustrate in Pl. 11, fig. 272, from a specimen of race *divergens* Rocci. I name this aberration of the genitalia **Melitaea athalia** (Rottemburg) exerge **helvetica** Rühl ab. **uncummimans** ab. n. The locality of the type specimen of this aberration (which is the specimen figured to which I have just referred and which is in the Verity collection) is Turbigo, Milan. In this aberration the hind-edge of the tegumen is produced into two long converging processes which very much resemble the uncus of exerge *athalia* (Rottemburg), except that they are inserted far apart from each other and exhibit no signs of the thick, dark, cuticle visible in the real uncus. These processes are of the same uniform translucence as the tegumen itself. It is probably an aberration not due at all to the admixture of a strain of exerge *athalia* (Rottemburg), like the synexergic forms referred to above, which have quite different-looking rudiments of the real uncus beginning with dark sclerotised knobs.

(a) Group of races of exerge *helvetica* Rühl in which the male genital armature is characterised by the absence of the uncus.[2]

(α) The asiatic race.[3]

(i) **MELITAEA ATHALIA** (Rottemburg) race **ASIAE** race n.

Pl. 1, figs. 21–23 ♂♂; 24 ♀; Genitalia pl. 10, fig. 267; and form *asiaefrigida* Verity, pl. 1, fig. 25 ♂; Genitalia pl. 10, fig. 268.

The discovery of a race of *M. athalia* (Rottemburg) occurring on the Pacific coast but possessing genitalia perfectly characteristic of exerge *helvetica* Rühl was quite unexpected, since it had previously been thought that the most easterly locality of this exerge was in southern Italy. I was therefore very surprised to find a number of such examples included by accident in a series of *mandschurica* Fixsen (*i.e.* of race *niphona* Butler of *M. ambigua* Ménétriés), which were kindly presented to me by Herr Rütimeyer of Bern, by whom they had been received direct from Professor Gerasimow of Leningrad. According to all the printed labels which these specimens bear they were captured in the "Mining district of Sutshansky, coast region, 1925," in Ussuria, the southern part of the Siberian coast. It seems therefore that there can be no possibility of a mistake having been made in regard to their origin. I have obtained a further confirmation of the presence of exerge *helvetica* Rühl in the Far East in another specimen, which I found in the collection of the late Max Bartel and which I purchased. This specimen, unfortunately, only bears the locality: "Siberia merid."

On examining the genitalia of these specimens, I found that they were highly characterised examples of exerge *helvetica* Rühl not only (a) by reason either of the complete absence of an uncus or by the presence of only minute rudiments of that process, but also (b) by the very short tegumen and (c) by the shape of the terminal process of the valve, which is long, thin, and smooth to the utmost degree and furthermore does not even exhibit the two usual well-developed terminal spines, but ends in one point only (as in *M. parthenoides* Kerferstein) with one or two extremely minute side spines along its edge. Reverdin only found this exceptional character in two specimens from Switzerland and I also have found very few indeed. It is thus quite exceptional in Europe. Whether it is constant in the Asiatic population here under discussion—and can thus be considered an ancestral feature—remains to be seen. The harpe process is, on

[2] For Group (b), see p. 618.
[3] For sub-section (β), see p. 613.

the contrary, not so characteristic (see its description above) of exerge *helvetica* Rühl and is more like that of exerge *athalia* (Rottemburg) by its shape and by the amount of teeth which it shows. It will be remembered, however, that in this particular respect *M. deione* (Geyer) is nearer to exerge *athalia* (Rottemburg) than to exerge *helvetica* Rühl. In general facies race *asiae* Verity is more similar to *melanographata* Beuret from the Tessin than to other European races by reason of its size, rich and bright fulvous colour and heavy and sharp black pattern in the male. The only female example which I possess is rather smaller and has a paler ground-colour than that of specimens from the Tessin and more resembles some examples of race *divergens* Rocci from the Po valley. Further, the undersides of all the typical material exhibit a thinner black pattern than is seen in most examples from the Tessin. Moreover, two males out of three exhibit the very broad yellowish-white space which is the characteristic of *latefascia* Fixsen, described from the Upper Amur, but not to be found amongst the specimens now extant in collections from that region, as I explain at length in dealing with *M. coreae* Verity. It may have been this Asiatic race of exerge *helvetica* Rühl which Fixsen had before him, although it would be too speculative to apply to race *asiae* Verity the name given by Fixsen, since one does not even know at present whether any race of exerge *helvetica* Rühl exists in the Upper Amur region at all.

The type of race *asiae* Verity, which is in the Verity collection, bears the locality label quoted above in common (as there explained) with all the paratypes of this race. The specimen from the Bartel collection (Pl. 1, fig. 25, and Pl. 10, fig. 268) mentioned above has a peculiar facies in that it is very melanic on the upperside, as may be seen from the figure, while the underside has all the chestnut markings very pale and yellowish, and the central space is broken up into round spots of a pure silvery white. The premarginal spaces are of this same white tone. Altogether, therefore, this insect recalls very much the nominotypical alpine race of exerge *helvetica* Rühl, and it is well worth distinguishing by the name of **Melitaea athalia** Rottemburg exerge **helvetica** Rühl, race **asiae** Verity form **asiaefrigida** form n., whether it turns out to be a racial, or whether it is simply an individual, form. The type of form *asiaefrigida* Verity, which is now in the Verity collection, is labelled " southern Siberia."

(β) Iberian races.[4]

(ii) *M. ATHALIA* Rottemburg race *IBERANANA* Verity.

Pl. 2, figs. 28 ♂, 29 ♀; Genitalia pl. 10, fig. 270 (same specimen as that illustrated on fig. 28 referred to above); and (Gen. I. *biedermanni* Querci) pl. 2, figs. 26 ♂, 27 ♀; Genitalia pl. 10, fig. 269 (same specimen as that illustrated on fig. 26 referred to above).

Melitaea athalia Rottemburg exerge *helvetica* Rühl race *iberagigas* Verity form (Gen. II) *iberanana* Verity, 1930, *Ent. Rec.* **42** : 135; *Melitaea athalia biedermanni* Querci, 1932, *Treb. Mus. Cienc. nat. Barcelona* **14** : 127.

I gave the name *iberanana* Verity to the second generation collected by Querci in central Portugal on the Serra de Estrela (800–1000 m.) from 24th July to 20th August. I chose this name as a contrast to the very large first generation of mid-June, which I then thought similar to *iberica* Staudinger (which on the same occasion I renamed *iberagigas* Verity, a name which later I found to be a synonym of *hispanica* Wnukowsky). Since then, Querci (1932, *Treb. Mus.*

[4] For sub-sections (α) and (γ), see pp. 612 and 615 respectively.

Cienc. nat. Barcelona **14** : 127) has pointed out that the former is larger and more variegated in colouring than the latter and has given it the name *biedermanni* Querci. It has a very much more accentuated black pattern than the very much smaller first generation *iberanana* Verity, which has a remarkably thin pattern and a quite even fulvous tone of colour, in this respect exactly resembling nominotypical *M. deione* (Geyer). In dealing with the latter species I have recalled that Querci suggested that the names *rosinae* Rebel and *philomela* Frühstorfer should be used for this race of exerge *helvetica* Rühl; and I have pointed out that the colour of the palpi, the form of the genitalia, and other features definitely exclude the possibility that Rebel should have made the mistake thus attributed to him. I have pointed out also that at least an examination of Frühstorfer's types must be made before accepting such a conclusion in the case of *philomela* Frühstorfer.

(iii) *M. ATHALIA* (Rottemburg) race *NEVADENSIS* Oberthür.

Melitaea deione Geyer race *nevadensis* Oberthür, 1904, *Ét. Lép. comp.* **1** : 15–16; *Melitaea athalia* Rottemburg race *nevadensis* Oberthür, *id.*, 1910, *ibid.* **4** : 672, pl. 45, figs. 355–358; *Melitaea athalia* Rottemburg form *magna* Seitz, 1909, *Grossschmett. Erde* **1** : 222, pl. 66, fig. I 5 ♀.

This race, the type of which was taken in the Sierra Nevada at Lanjaron, was (as shown above) originally described by Oberthür as a race of *M. deione* (Geyer), but on closer inspection that author subsequently quite correctly referred it to *M. athalia* (Rottemburg). The figures given by Oberthür seem to confirm this conclusion perfectly, contrary to Ribbe's statement that *M. athalia* (Rottemburg) does not exist in southern Spain. I have already noted, while dealing with *M. deione* (Geyer), that the insect named *magna* Seitz, the precise identity of which is uncertain, appears more likely to be identical with *M. athalia* Rottemburg race *nevadensis* Oberthür than with *M. deione* Geyer race *nitida* Oberthür. For the present, at least, it should be regarded as a synonym of race *nevadensis* Oberthür.

(iv) *M. ATHALIA* (Rottemburg) race *HISPANICA* Wnukowsky.

Pl. 2, figs. 30 ♂, 31 ♀.

Melitaea athalia hispanica Wnukowsky, 1929, *Zool. Anz.* **83** : 222 (nom. n. pro *M. athalia* Rottemburg var. *iberica* Staudinger, 1901); *Melitaea athalia* Rottemburg race *iberagigas* Verity, 1930, *Ent. Rec.* **42** : 134 (nom. n. pro *M. athalia* Rottemburg var. *iberica* Staudinger, 1901); *Melitaea athalia* Rottemburg var. *iberica* Staudinger, 1901, *Cat. Lep. pal. Faunengeb.* : 32 (invalid, because a homonym of *Melitaea artemis* [Schiffermüller & Denis] var. *iberica* Oberthür, 1881).

Staudinger gave " central Spain and northern Portugal " as the locality of *iberica* Staudinger, and that locality is therefore the type locality for *hispanica* Wnukowsky. Querci recorded this race as being " usually large and more variegated on the upper surface than those of the Castiles."

(v) *M. ATHALIA* (Rottemburg) race *ARANENSIS* Sagarra.

Melitaea helvetica Rühl race *aranensis* Sagarra, (1931) *Butll. Inst. catal. Hist. nat.* (2) **10** : 115; *Melitaea helvetica* Rühl race *aguilari* Sagarra, Querci *nec* Sagarra, 1932, *Treb. Mus. Cienc. nat. Barcelona* **16** : 128.

This race, which was described from specimens taken at Salardù als Banys de Tredòs (Aràn), occurs in cold and damp alpine surroundings in the Pyrénées of Catalonia and Aragon. It is paler than the preceding and has a more extensive

black pattern and a conspicuous black suffusion at the base of the wings on the upperside. In the specimens from Salardù these features are the most highly accentuated. Querci, by mistake, cited this race under the non-existent name *aguilari* Sagarra.

(γ) Races of Peninsular Italy.[5]

Passing to the races of Peninsular Italy belonging to the exerge *helvetica* Rühl, I must first acknowledge that my original descriptions of some of these races are unfortunately somewhat confused, owing to the fact that I did not at first possess the proper material and knowledge to enable me to establish their characters clearly. Now, however, this can be done in the following account which constitutes a summary of what I have written about these races at different times as and when specimens came to hand.

As I have already mentioned, all the races from Peninsular Italy enumerated below are no doubt derived from ancestors possessing the same hereditary factors and owe their different facies to the action of differences in the surroundings in which they live. These differences modify each individual during its growth and development, thus producing the type of form which geneticists call a " somation," as contrasted with the type of form differentiated by reason of hereditary characters. For example, the damp hot conditions present in the coastal swamps produce the extreme degree of development seen in race *maxima* Turati, and (more commonly) the lesser degree exhibited by race *submaxima* Verity, the next race in this scale of variation. On the other hand, drought, especially when accompanied by the cooler climates of mountain districts, produces successively a series of races exhibiting variations in the opposite direction. An example of this phenomenon is afforded by races *deioneformis* Verity, *tenuis* Verity and *tenuicula* Verity, as is shown by the way in which these races gradually grade into one another in accordance with progressive changes in their surroundings. A further piece of evidence is afforded by the fact that insects identical with race *tenuis* Verity have been known to occur as the second generation of populations the first generation of which belong to race *submaxima* Verity.

(vi) *M. ATHALIA* Rottemburg race *DEIONEFORMIS* Verity.

Pl. 2 figs. 32 ♂, 33, 34 ♀♀.

Melitaea athalia Rottemburg var. *deioneformis* Verity, 1914, *Bull. Soc. ent. ital.* **45** : 208.

I gave this name to the race from " central Italy," which I described as follows : " ground colour and, on underside, russet markings very pale; black pattern extremely thin (*deioneformis* mihi = *nevadensis* Obth.)." As I then thought that this form was quite similar to *nevadensis* Oberthür from Spain I suggested in the footnote of page 208 that my more suitable descriptive name might be used also to replace the name *nevadensis* Oberthür, which I then believed to be invalid, wrongly believing it to be a homonym. In reality, however, closer inspection shows that the Italian form is usually smaller and less pale than the Spanish one; the underside russet markings are only in exceptional cases reduced and yellowish to the extent that they usually are in race *nevadensis* Oberthür, whereas the black markings of the fore-wing are, on that surface, more effaced. Turati was, therefore, perfectly right when a few months later he applied the name *deioneformis* (1914, *Att. Soc. ital. Sci. nat.* **53** : 599) to the race of the coast ranges of the southern parts of central Italy,

[5] For sub-section (β), see p. 613.

in which the most *nevadensis*-like individuals occur. I have a series from the Mollarino valley at 500 m., in the Mainarde Mts., from which locality I figure these examples. This application of the name was, subsequently, defined still more closely by me when I described and named the next following race.

(vii) *M. ATHALIA* Rottemburg race *TENUIS* Verity.

Pl. 2 figs. 35 ♂, 36 ♀.

Melitaea athalia Rottemburg race *tenuis* Verity, 1919, *Ent. Rec.* **31** : 193–194; *Melitaea helvetica* Rühl form (razza) *pusilla* Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 209.

This race is smaller and less pale on both surfaces than race *deioneformis* Verity, and on the average the black pattern is thicker than in that race. In consequence the *nevadensis*-like aspect seen often in race *deioneformis* Verity is scarcely ever attained in the present race, even in the female sex. Individuals which resemble *M. deione* (Geyer) on the upperside owing to their extremely thin black markings are not as frequent as in race *deioneformis* Verity. In my original description of race *tenuis* Verity I gave the type locality as " Pian di Mugnone near Florence." This race occurs typically in the northern parts of central Italy up to an elevation of 1500 m. It occurs also locally in the portions of the region where race *deioneformis* Verity occurs in other localities. Specimens transitional between these two races and others on the one hand, and the coastal race *submaxima* Verity on the other hand, produce individuals of very varied aspect.

Rocci gave the name *pusilla* Rocci to the race, which in Liguria replaces race *submaxima* Verity at a distance from the coast in the chestnut zone from 500 m. upwards. Rocci took as typical a series from the Bisagno and the Scrivia valleys. This race has two generations, of which the second is, according to Rocci, a little smaller than the first. In reality, *pusilla* Rocci is, however, nothing but one of the *tenuis* Verity populations, which exhibit signs of transition to race *submaxima* Verity, precisely as occurs in many localities of the Tuscan Apennines. Rocci's typical series has lately passed into my possession together with the whole of the Rocci collection, so that I am able to compare the types of *pusilla* Rocci with those of *tenuis* Verity. As a result I find that there are no differences between them. Thus, *pusilla* Rocci falls as a synonym of *tenuis* Verity. Rocci has since agreed that this determination is correct.

On the Portofino Hill there is a population exactly intermediate between race *tenuis* Verity and race *submaxima* Verity.

(viii) *M. ATHALIA* Rottemburg race *TENUICULA* Verity.

Pl. 2, figs. 37, 38 ♂♂, 39 ♀.

Melitaea athalia Rottemburg race *tenuicula* [sic] Verity, 1919, *Ent. Rec.* **31** : 193–194.

This is a remarkable minute race, which may be regarded as a somation of race *tenuis* Verity. It occurs in particularly alpine surroundings such as those afforded by the large massif of the Sibillini Mountains in the Piceno. The type came from this region, having been caught at Bolognola (Piano Astore) at an elevation of 1200 m. In my experience, the race in the Apennines is always race *tenuis* Verity up to an elevation of 1400 m. At the Passo delle Radici, at an elevation of 1500 m., I actually found a large race transitional to the following race (*submaxima* Verity).

(ix) *M. ATHALIA* Rottemburg race *SUBMAXIMA* Verity.

Pl. 2, figs. 40, 41 ♂♂, 42 ♀; Genitalia pl. 10, fig. 271.

Melitaea athalia Rottemburg race *submaxima* Verity, 1924, *Ent. Rec.* **36** (Suppl.) : (40).

This race, which (like the preceding) may be regarded as a somation of race *tenuis* Verity, occurs in damp localities along the coasts of Italy, including Liguria. It was described from Forte dei Marmi in northern Tuscany. It is characterised by its very large size (length of fore-wing 22 mm. in both sexes) and by its brightly coloured and bold pattern.

(x) *M. ATHALIA* Rottemburg race *MAXIMA* Turati.

Pl. 2, figs. 43 ♂, 44 ♀.

Melitaea athalia maxima Turati, 1911, *Annu. Mus. zool. Univ. Napoli* (n.s.) **3** (18) : 19.

This race is on the average still larger than race *submaxima* Verity, the average length of the fore-wing being 20–21 mm. in the male, and 22 mm. (occasionally 23–24 mm.) in the female. It is even darker in colour than that race. It was described from a specimen taken at Paola on the seashore of Calabria. It occurs also on the Isle of Elba at Puggio (500 m.).

(xi) *M. ATHALIA* Rottemburg race *RHODOLEUCA* Stauder.

Melitaea athalia Rottemburg form *rhodoleuca* Stauder, 1914, *Z. wiss. InsektBiol.* **10** : 374; *Melitaea athalia* Rottemburg race *obscura-maxima* Verity, 1921, *Ent. Rec.* **33** : 213.

The types of both *rhodoleuca* Stauder and of *obscura-maxima* Verity were taken at S. Fili in the Calabrian coast range. Stauder applied the name *rhodoleuca* Stauder to a male example, exhibiting a partial melanism, with the basal half of the wings yellowish-white instead of fulvous. Later I applied the name *obscura-maxima* Verity to the race as a whole, which is a very variable one made up of a mixture of individuals, some similar to race *maxima* Turati and others to the somation of that race which I have named *obscura* Verity. Personally, I consider that the name *obscura-maxima* Verity should be used for this race, since the name *rhodoleuca* Stauder is based upon an aberrant individual. (For a further note on this point, see the note by Mr. Hemming, printed on p. 690 below.)

(xii) *M. ATHALIA* Rottemburg race *OBSCURA* Verity.

Melitaea athalia Rottemburg race *obscura* Verity, 1919, *Ent. Rec.* **31** : 194.

This race was described from examples taken on the Altipiani di Carmelia (1200 m.) on the Aspromonte in Calabria. It is larger than race *deioneformis* Verity, and is of a deeper reddish tinge, with a thicker black pattern. The female is extensively suffused with black on the upperside.

(xiii) *M. ATHALIA* Rottemburg race *SICULA* Turati.

Pl. 2, figs. 45 ♂, 46 ♀.

Melitaea athalia Rottemburg form *sicula* Turati, 1915, *Atti Soc. ital. Sci. nat.* **53** : 600.

The type series of this race from Sicily was taken at Ficuzza in the Province of Palermo. This is a smaller race than *obscura* Verity, and is somewhat

intermediate in aspect between the last-named race and race *decioneformis* Verity, both as regards colour and pattern. Its chief characteristic consists in the broad suffusion of greenish-grey scaling which the female exhibits in the basal half of the wings on the upperside.

(b) Group of races of exerge *helvetica* Rühl in which the male genital armature is characterised by the presence of a rudimentary uncus (two knobs, with or without tiny spikes, set broadly apart from one another).[6]

In this group, as in the preceding, the race of each region exhibits two principal opposite facies, which are somations, in connection with the nature of the surroundings which they inhabit. I therefore recall the fact that, although I record them all here as " races," for the sake of uniformity, this term can and should in some cases be interpreted in the more definite sense of " somations." I indicate this particularly in the case where two opposite forms (races) occur together in the same region because evidently this is a case in which morphological resemblances would lead one wrong (if blindly followed), such opposite forms being much more closely connected to each other than each of them is to the corresponding similar form of another region, however much it may resemble the latter. In each region the somation which was the first to receive a name should of course give that name to the entire race.

(xiv) *M. ATHALIA* Rottemburg race *DIVERGENS* Rocci.

Pl. 2, figs. 48 ♂, 49 ♀; gen. II form *postdivergens* Verity, pl. 2, fig. 47 ♂; Genitalia pl. 11, fig. 272 (ab. *uncumminans* Verity).

Melitaea helvetica Rühl razza *divergens* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184–185; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 23, pl. 3, fig. 1, 3 ♂, 2 ♀ ; (form. vern.) *Melitaea helvetica divergens* Rocci form *maximaeformis* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 25, pl. 3, figs. 4 ♂, 5–7 ♀♀ ; (Gen. aest.) *Melitaea helvetica divergens* Rocci form *postdivergens* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 26, pl. 3, figs. 8, 9, 11 ♂♂, 10 ♀; (form. aest.) *Melitaea helvetica divergens* Rocci form *partheniaesimilis* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 26, pl. 3, figs. 12 ♂, 13 ♀.

This is the widespread race of the plains of the Po basin. It was described from Turbigo and Soria, in the swampy meadows on the banks of the Ticino, and is, therefore, the " damp " somation of its race.

It may be described as follows :

Large size, on an average; light colouring on both surfaces of wings; shape of wings usually broad and rounded; black pattern bold, but sharp in outline and without thick bands; females usually with rather thicker bands than the males, but never melanistic. At the western end of its habitat, such as at Turin, there is an obvious transition to race *celadussa* Frühstorfer of the Alps of Piedmont.

This transitional form is characterised by its smaller size, more elongated wings, thicker pattern and more black suffusion at the base of the wings. The race from there can be designated correctly race *divergens* Frühstorfer *trans. ad* race *celadussa* Frühstorfer.

The second generation differs chiefly from the first by its smaller size, but the tone of the fulvous is, on the average, also rather lighter and the pattern thinner.

As individual variation is considerable in this race, Rocci has thought it

[6] For Group (a), see p. 612.

advisable to name the largest of these variations (which appears in mid-June) *maximaeformis* Rocci and the smallest one with a thin pattern form *partheniae-similis* Rocci.

I have examined the genitalia preparations made by Rocci in his type series, and I must state that there is none transitional to those of *M. britomartis melathalia* Rocci which flies with *M. athalia divergens* Rocci, as Rocci supposed some to be.

(xv) *M. ATHALIA* Rottemburg race *HASTENSIS* Rocci.

Pl. 2, fig. 50 ♂.

Melitaea helvetica Rühl form (razza) *hastensis* Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 208.

The types of this race, which should be regarded as the dry somation of race *divergens* Rocci, came from the Monferrato in southern Piedmont. It occurs from the River Po to the foot of the Ligurian Apennines (types from Asti), with two generations. This dry and hot region, famous on that account for its wines, produces southern-looking forms in other species as well as in this one, which is very small and has very thin markings, that are in part even obliterated, the ground-colour being a clear bright warm fulvous.

(xvi) *M. ATHALIA* Rottemburg race *CELADUSSA* Frühstorfer.

Pl. 3, figs. 51 ♂, 52 ♀.

Melitaea athalia celadussa Frühstorfer, 1910, *Soc. ent.* **25** : 51.

This race, which was described from specimens taken at the Col di Tenda in the Maritime Alps, although remarkably variable, both individually and locally, is on the whole recognisable among all the races of *M. athalia* (Rottemburg) of the western Alps of Italy and France. It occurs in a form transitional to *luciflua* Frühstorfer in the mountains of the south-east of France, as is shown from specimens in my possession from the Cevennes, where, at Hospitalet, 800 m., the population can well be referred to the intermediate race *subluciflua* Verity. In addition, the same form is found in several mountain localities in the Department of the Alpes Maritimes, *e.g.* Vence, Saint Barnabé, etc., in damper and cooler surroundings.

The most highly characterised populations from high altitudes in the Alps have a very bold thick pattern in both sexes, and the females are often very melanistic, with a light yellowish ground-colour, but as a rule the facies is transitional to the dry somation *luciflua* Frühstorfer and therefore less heavily marked and brighter in the tone of the fulvous, besides being also smaller in size in many individuals. This is the case in my long series from Oulx and Cesana, in the Susa valley, as well as in those from the regions of Vence, above Nice.

The race of *M. athalia* (Rottemburg) from Gèdre in the Hautes-Pyrénées seems to the naked eye perfectly identical to the most alpine examples of *celadussa* Frühstorfer from the Maritime Alps. I shall, however, show presently that they exhibit a small uncus, such as is never found in the latter. They must therefore be dealt with in the group of races which possess the same character.

(xvii) *M. ATHALIA* Rottemburg race *LUCIFLUA* Frühstorfer.
Pl. 3, figs. 53, 55 ♂♂, 54, 56 ♀♀.

Melitaea athalia luciflua Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 5.

This race should be regarded as the dry somation of race *celadussa* Frühstorfer. It was described from specimens taken on the Petit Salève near Geneva. It is remarkably pale and small, and recalls race *hastensis* Rocci from the opposite side of the Alps by reason of its size and of the thinness of the black markings, which, on the underside, are reduced on the hind-wing to an extreme degree. Frühstorfer described this race as being like race *melida* Frühstorfer but with a higher and broader medial zone on the underside of those wings. He added it was the dominating race also in the lower Valais and part of the Maurienne and the Tarantaise in Savoy. As a matter of fact it is, as far as I have been able to make out, the form of the driest and hottest localities of the whole of the south-east of France, either in its most extreme typical form or in the following, which is a lesser or greater approach to *celadussa* Frühstorfer and which I have separated under a distinct name, because the intermediate facies is in many localities too different from both *celadussa* Frühstorfer and *luciflua* Frühstorfer to bear either of those names correctly.

I possess examples from Geneva of a second generation taken between 15th and 21st August, which seems worthy of a distinctive name by its still smaller size, some individuals not being larger than normal-sized examples of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), the length of the fore-wing being 16–19 mm. in the male, by its still thinner pattern and, in some cases, by its very pale, yellowish ground-colour. I name this form **Melitaea athalia** Rottemburg exerge **helvetica** Rühl race **luciflua** Frühstorfer form **postluciflua** form. n.

(xviii) *M. ATHALIA* Rottemburg race *SUBLUCIFLUA* Verity.
Pl. 3, fig. 57 ♂, 58 ♂ (Gen. II form *postsublucifiua* Verity).

Melitaea athalia Rottemburg race *sublucifiua* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : (74).

This race, which may be regarded as the dry somation of race *celadussa* Frühstorfer, was described from specimens taken at Martigny in the lower Valais. In this locality some examples are transitional to the less extreme examples of race *luciflua* Frühstorfer from Geneva, but most of them have thicker black bands than in that race, and the ground-colour is of a richer fulvous tone. In this latter respect, the most extreme examples are similar to those of race *veragrorum* Verity, except that they are always considerably smaller in size.

In addition to occurring in the lower Valais, this race is found also in the Cevennes, from which region it is represented in my collection. It occurs also at low altitudes in southern France, *e.g.* between Vence and La Tourette. In this last-named region the second generation is distinctly smaller than the first, the average length of the fore-wing of the males of the two generations being 19 mm. and 16–17 mm. respectively, the corresponding figures for the females being 20–21 mm. and 18 mm. respectively. This smaller second generation I name **Melitaea athalia** Rottemburg race **subluciflua** Verity form **postsubluciflua** form. n. The type specimen of this form is in the Verity collection. The locality given on the label is " between Vence and La Tourette "; it was taken at an elevation of 300 m. on 20th August.

(xix) *M. ATHALIA* Rottemburg race *VERAGRORUM* Verity.

Pl. 3, figs. 59 ♂, 60, 61 ♀♀; Genitalia pl. 11, fig. 273.

Melitaea athalia Rottemburg race *veragrorum* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : (74).

This race was described from specimens taken in the damp meadows of the Upper Rhone Valley between Bex and the Lake of Geneva. It is evidently the damp somation of race *subluciflua* Verity. It not only replaces race *celadussa* Frühstorfer in that region but occurs also on the northern watershed of the Alpine chain in warm valleys as far east as the Rhaetian Alps. In the latter region, Rütimeyer collected a fine series at Soglio in the Val Gregaflia at an elevation of 1100 m. just south of the watershed. These specimens from Soglio agree exactly with the type series of race *veragrorum* Verity in my collection.

This race is on the whole intermediate between races *celadussa* Frühstorfer and *melangraphata* Beuret of the southern watershed of those same mountains. It has the greater depth of tone of the black markings and the richer and warmer one of the fulvous, which Beuret has pointed out as the features distinguishing his race from race *celadussa* Frühstorfer, but the female exhibits the more extensive black pattern and the lighter and often whitish ground-colour of that of the latter, whereas in race *melangraphata* Beuret there is less sexual dimorphism and a consequent greater resemblance to race *divergens* Rocci.

(xx) *M. ATHALIA* Rottemburg race *SUBHELVETICA* Verity.

Pl. 3, figs. 62 ♂, 63 ♀.

Melitaea athalia Rottemburg race *subhelvetica* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : (76).
Melitaea athalia Rottemburg form *alpestris* Vorbrodt, 1928, *Deuts. ent. Z. Iris* **42** : 21 (invalid because a homonym of *Melitaea dictynna* Esper form *alpestris* Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 14).

This is the race from the Loetschenthal. It is represented in my collection from Wyler-Ried, Ried Fasleralp and Platten. No doubt it is the race of most high mountain localities of that part of the alpine chain. It exhibits the alpine features of *helvetica* Rühl of the eastern Alps, but to a distinctly lesser extent, just as do the corresponding races of allied species, such as *M. varia* Herrich-Schäffer in these two regions.

It is characterised by its small size, by the broad black suffusion at the base of the wings, especially in the female, by the light, whitish tone of the fulvous in this sex and, on the underside of the hind-wings (as a rule), by a row of white spaces with a strong silvery sheen, right across them.

Vorbrodt (1928) gave the name of *alpestris* Vorbrodt to a form which he described as a " striking, small mountain form, usually also darker, with more accentuated black markings and a ⩦ mark on the fore-wing," from the Risselberg, Risselalp and Tristalp. This is, evidently, the extreme alpine form of *subhelvetica* Verity. The name of *alpestris* is, however, invalid, if used racially, because it had been given by Fruhstorfer to a form of *M. diamina* (Lang) (= *dictynna* Esper).

(xxi) *M. ATHALIA* Rottemburg race *MELIDA* Fruhstorfer.

Pl. 3, figs. 64, 68 ♂♂, 65, 66 ♀♀; (Gen. II form *postmelida* Verity) pl. 3, fig. 67 ♂; Genitalia pl. 11, figs. 274, 275.

Melitaea athalia melida Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 182.

This race was described from Maroggia and the slopes of the Monte Generoso

in the Tessin up to an elevation of about 1200 m. Frühstorfer in his original description cited also the following localities: Mt. Lema, from 700 to 1000 m., Mt. S. Salvatore, Mt. S. Giorgio and Mt. Boglio, near Lugano, but series in my possession range from the east coast of Lake Maggiore (Laveno, Valtravaglia, etc.), thence eastwards to beyond Lake Como in the Valtellina (Val Bitto). It can therefore be considered the dry somation from the Prealps, between the ranges of races *hastensis* Rocci in Piedmont and *delminia* Frühstorfer in the Upper Adige basin. It is intermediate also in facies both as regards size and extent of pattern and tone of fulvous, but it exhibits a great deal of variation according to the tendency which it has to take the aspect of its damp somation to a lower or higher degree in the various localities. Frühstorfer has pointed out the remarkable extent to which it sometimes, and notably in the female sex, acquires southern features, by the extensive obliteration of the black pattern and by the lightness of the ground-colour, quite comparable (according to him) to the races of Spain, though I should say more exactly to *deioneformis* Verity of southern Italy. It has two generations, and the second, smaller one is worthy of distinction: **Melitaea athalia** Rottemburg exerge **helvetica** Rühl race **melida** Frühstorfer form **postmelida** form. n. (fig. 67).

(xxii) *M. ATHALIA* Rottemburg race *MELANGRAPHATA* Beuret.

Pl. 3, figs. 69 ♂, 70 ♀.

Melitaea helvetica melangraphata Beuret, 1932, *Mitt. schweiz. ent. Ges.* **15**: 451, pl. 6, figs. 4, 6 (larva), 9 (genit.); pl. 7, figs. 5–7 (pupa).

This race should be regarded as the damp somation of race *melida* Frühstorfer. In his description of that race Frühstorfer remarked that the races of *M. athalia* (Rottemburg) found in the other valleys and mountains of the Tessin differed very much from the thinly marked race *melida* Frühstorfer with its pale females. He further observed that the race from these regions was much more reminiscent of race *delminia* Frühstorfer owing to its richer colouring and heavier pattern. This is the race which has since received the name *melangraphata* Beuret. Beuret's types were taken in the Canaria Valley, paratypes being taken at Fusio. All the typical material was taken in June. The genitalia were examined by Beuret and found to be perfectly typical exerge *helvetica* Rühl. This race extends beyond the Tessin, like *melida* Frühstorfer. I have it from several localities in the Prealps of Lake Maggiore and I have collected it far up into the Anzasca Valley, at Vanzone, 700 m., south of Mount Rosa. In 1935 (*Ent. Rec.* **47** (Suppl.): (75)) I made the mistake of referring the insects from the latter locality to *divergens* Rocci, but the more heavy black pattern and the richer tone of fulvous plainly show that they are referable to *melangraphata* Beuret, as I have described it and distinguished it above in dealing with *veragrorum* Verity, which replaces it on the northern watershed of these Alps.

A second generation is produced even at the altitude of Vanzone and is distinguished by the usual smaller size, the fore-wing measuring about 18–19 mm. as compared with 20–21 mm. in the first generation. I name this generation **Melitaea athalia** Rottemburg exerge **helvetica** Rühl race **melangraphata** Beuret form **postmelangraphata** form. n. The type of this form, which is in the Verity collection, was taken with other specimens between 19th August and 2nd September.

(xxiii) *MELITAEA ATHALIA* Rottemburg race *HELVETICA* Rühl.

Pl. 3, figs. 71, 73 ♂♂, 72, 74 ♀♀; Genitalia pl. 11, fig. 276 (same specimen as that illustrated on fig. 71 referred to above).

Melitaea athalia Rottemburg var. *helvetica* Rühl, 1888, *Soc. ent.* **3** : 137.

It seems right to include at this point both this, and the following, races of eastern Switzerland, which exhibit the alpine facies to the highest degree attained by *M. athalia* (Rottemburg). I have described the general features of these races in the paragraph on race *subhelvetica* Verity. This seems to be their proper systematic position, because their typical form has a male genital armature, which belongs most distinctly to the *helvetica* Rühl (= *pseudathalia* Reverdin) structure, having notably a very short crescentic tegumen and very long smooth posterior processes of the valves, with only two terminal spines, but which, on the other hand, has a small uncus, consisting in two well-developed points. Similar ones are found, now and then, also in the preceding races of this group, and I have some examples of races *divergens* Rocci and *melida* Frühstorfer, as far west as Lake Maggiore, but in races *helvetica* Rühl and *noctula* Frühstorfer this appears to be the predominating form. Both Higgins (1932, *Entomologist* **65** : 219, pl. 6) and Beuret have found that races *helvetica* Rühl in the Engadine and *noctula* Frühstorfer at Glärnisch and from there eastwards exhibit a gradual transition to the fully developed uncus and the other characters of true *M. athalia* (Rottemburg). One might therefore feel doubtful as to whether these two races should not be placed rather in the group of synexerges which I describe later. I think, however, that it is more exact to place here the races of localities where there are, apparently, pure strains of race *helvetica* Rühl, and to distinguish as synexerges (using a compound name) those where transitions to true *M. athalia* (Rottemburg) have been discovered.

Race *helvetica* Rühl, which was described from Stalla and Bergün, in the Grisons (end of July), has a highly alpine facies, namely small size, dull fulvous, often replaced by yellow in the premarginal spaces of the female, considerable extent of the black pattern and especially of the basal suffusions, but with the fulvous space between the end of the cell and the premarginal streaks remarkably broad on the hind-wing and divided by the black nervures into five oblong spots, as specially noted by Rühl. On the underside, the corresponding clear spaces are of a pure silvery white, as in *M. varia* Herrich-Schäffer and other Alpine species of *Melitaea* Fabricius, thickly bordered with black, the basal russet markings being often unusually broad and blended together.

(xxiv) *M. ATHALIA* Rottemburg race *NOCTULA* Frühstorfer.

Pl. 8, figs. 215–217 ♂♂, 218, 219 ♀♀; Genitalia pl. 11, fig. 277 (same specimen as that illustrated on fig. 215 referred to above).

Melitaea athalia noctula Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 184.

The male holotype, which I figure (pl. 8, fig. 215), was taken in the Erstfeld Valley, and bears a label to this effect by Frühstorfer. Most of the paratypes are from the Glärnisch, in the Canton Glarus, 1400–1800 m. The Maderan Valley, 1300–1500 m., is mentioned also in the original description, as also are the Alps of Algau, where the females are said to be tawny instead of having yellowish spaces as in the former localities.

This race was described by Frühstorfer as extremely and very constantly

melanistic and very small, the aspect of the male very much recalling that of *M. aurelia* Nickerl (i.e. *M. parthenie* Borkhausen), and the one of the female recalling *M. diamina* race *vernetensis* Oberthür. To my mind, the large series in the Frühstorfer collection scarcely seems worth distinguishing from the true race *helvetica* Rühl of the Rhaetian Alps, except by the fact that melanistic individuals are actually more abundant in that series than in the latter. The figure (pl. 11, fig. 277) of the genital armature of the type of *noctula* Frühstorfer shows that this structure agrees exactly with that of race *helvetica* Rühl.

SECTION II.—Synexergic races, *i.e.* races partaking in different ways of the characters both of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) and of exerge *athalia* (Rottemburg).[7]

It is obviously convenient to place in a separate section (as I do here) all those races of *M. athalia* (Rottemburg) which partake in different ways of the characters both of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) and of exerge *athalia* (Rottemburg). These races fall into two classes, viz. :—

(i) races some individuals of which are referable to exerge *helvetica* Rühl and others to exerge *athalia* (Rottemburg), together with examples of an intermediate character, often thought to be hybrids; and
(ii) races the bulk of the individuals of which are referable to a pure strain of either exerge *helvetica* Rühl or exerge *athalia* (Rottemburg), mixed with individuals intermediate in character.

As I have already said, I do not think that the term " hybrid " is at all a suitable term to apply to such cases, since not even the purest of the stocks concerned are specifically distinct from one another. There can, however, be no doubt that the intermediate forms in question are the result of crossings, since the two exerges of *M. athalia* (Rottemburg) maintain their characteristics strictly throughout the whole of the vast territories in which they occur, but do not occupy adjoining localities. It is only where the areas occupied by the two exerges approach one another that intermediate specimens occur, but in such regions they are abundant. This phenomenon can only be accounted for by concluding that overlapping and consequent crossing has occurred. This intermediate zone extends from western Austria (Salzburg) northwards through northern Switzerland; farther south it passes the watershed of the Alps, reappearing in the Upper Adige and certain adjoining regions, though the Tessin and Piedmont are inhabited by pure races of exerge *helvetica* Rühl. Nothing is known regarding the size or position of this intermediate zone in central France, but in the west it is known to reappear in the Department of the Gironde. In northern Spain (as I have shown) this species is represented by a pure race of exerge *athalia* (Rottemburg) in a few mountain localities, but this race is extremely rare, and (except in the Pyrenees) exerge *athalia* (Rottemburg) does not seem to exercise any influence on the numerous races of exerge *helvetica* Rühl found in Spain.

In 1932 Higgins (*Entomologist* **65** : 217–223, pls. 5, 6) gave figures of a number of specimens of synexergic races showing the successive grades of transition which they exhibit.

In all this zone, some of the intermediate individuals exhibit the long slender rod-like processes of the uncus which I have already described and discussed

[7] For Section I and Section III, see pp. 610 and 629 respectively.

at length. To the east of it in the extreme north-east of Italy and in the northern Balkans there are no races of exerge *helvetica* Rühl, and the foregoing type of uncus is either found alone (and thus, quite racially, in some localities), or is found in well-characterised races of exerge *athalia* (Rottemburg). As already stated, I treat the races of those regions as belonging to the exerge *athalia* (Rottemburg), but I keep them apart in a special group when that particular type of uncus is a constant racial feature.

In the following list I have arranged these races according to the gradual increase which they display in the characters of exerge *athalia* (Rottemburg) as compared to those of exerge *helvetica* Rühl.

(xxv) **MELITAEA ATHALIA** Rottemburg race **MIXTACELADUSSA** race n.
Pl. 3, figs. 76 ♂, 77 ♀; Genitalia pl. 11, fig. 278.

The race which occurs at Gèdre in the Hautes-Pyrénées, as I have explained in my discussion of race *celadussa* Frühstorfer, does not to the naked eye appear to differ from the race from the Maritime Alps. Higgins has found, however, that in the Pyrenees—to be precise at Argeles in the Department named above—the race contains a strain of exerge *athalia* (Rottemburg), as is clearly evidenced by the male genital armature, though on the whole the specimens dissected showed closer affinity to exerge *helvetica* Rühl than to exerge *athalia* (Rottemburg). I also possess a specimen the genitalia of which are characterised by the presence of a small uncus.

I have therefore applied the above name to this Pyrenean race, which can only be described as superficially indistinguishable from race *celadussa* Fruhstorfer, from which, however, it differs by the male genitalia possessing a small uncus.

The holotype of this race is a male in the Verity collection taken at Gèdre in the Hautes-Pyrénées.

(xxvi) *M. ATHALIA* Rottemburg race *PSEUDATHALIA* Reverdin.

Melitaea pseudathalia Reverdin, 1920, *Bull. Soc. ent. France* **1920** : 319–321, text-fig.; *id.*, 1922, *Bull. Soc. lép. Genève* **5** : 24–25, pl.

When Reverdin first published this name, he was concerned to demonstrate the existence (as he thought) of a hitherto unrecognised species previously confused with *M. athalia* (Rottemburg). He accordingly enumerated all the districts in which, according to the genitalia preparations which he had made, it was known to occur. The districts which he mentioned were : the Hautes-Pyrénées; Pyrénées-Orientales; Bouches-du-Rhône; Var; Basses-Alpes. In indicating these localities, Reverdin was certainly not thinking of the question of the type locality of his new insect. When, two years later (1922), he described this insect more fully and gave figures of it, he figured first (pl. 1, figs. 6 ♂, 7 ♀) a pair collected at Versoix near Geneva, which can only be referred to race *luciflua* Frühstorfer, an insect which (as I have shown) had been described by Frühstorfer in 1917 from specimens taken on the Petit Salève near Geneva. On the same plate (pl. 1, fig. 8), however, Reverdin gave a figure of a male taken at Tramelan in the Bernese Jura. This insect belongs to a race which may be distinguished from race *luciflua* Frühstorfer by its smaller size, by the considerably more extensive nature of the black pattern on both upper and under surfaces, and by the basal suffusion on the upperside. This Tramelan race, which is otherwise unnamed, may, in the absence of a specific indication

to the contrary by Reverdin, be treated as the race to which the name *pseudathalia* Reverdin should be applied. Reverdin stated (on p. 31) that he had examined the genitalia of several specimens from Tramelan and found them to be " all normal *pseudathalia*," except one which he referred to *pseudathalia* Reverdin also but which had the terminal apophysis of the valve absolutely characteristic of exerge *athalia* (Rottemburg). As this locality is on the extreme northern limit of the exerge *helvetica* Rühl (between 47° and 48° lat.), and therefore in direct contact with pure strains of exerge *athalia* (Rottemburg), it is no matter for surprise that it should not be quite a pure race of exerge *helvetica* Rühl. No doubt transitional individuals occur, as in the Soleure district, but they are scarcer than at Tramelan, owing to the scarcity of exerge *athalia* (Rottemburg). According to all probabilities, the Tramelan race thus constitutes the first degree of admixture of the strain of exerge *athalia* (Rottemburg) with that of *helvetica* Rühl.

(xxvii) *M. ATHALIA* Rottemburg race *SYNEXERGICA* Verity.

Melitaea athalia Rottemburg race *synexergica* Verity, 1930, *Ent. Rec.* **42** : 133.

This is the race from the Soleure canton and of the Jura near the frontier of the canton of Bâle-Campagne (Baerschwil, Wasserburg and Fringeli), which Reverdin (1922, *Bull. Soc. lép. Genève* **5** : 31, 33, 36) found to consist entirely of unusual forms of all kinds intermediate between exerge *helvetica* Rühl and exerge *athalia* (Rottemburg), in that all the characters of the genitalia are mixed up in various ways. Reverdin concluded that most of them belonged on the whole to *pseudathalia* Reverdin, *i.e.* to exerge *helvetica* Rühl, but this population he found most embarrassing and he could not include the Soleure canton amongst the localities inhabited by it. He had similar mixed specimens also from Isenfluh, in the Bernese Oberland. One may conclude, therefore, that a small population of exerge *athalia* (Rottemburg) must have overlapped with the main population of exerge *helvetica* Rühl as far south as this point and there produced a more mixed race than the first degree race *pseudathalia* Reverdin. The race described by Hormuzaki (1934, *Bul. Fac. Stii. Cernauti* **8** : 37) from the Rettenbach Valley, near Ischl, to the east of Salzburg, in western Austria, corresponds very closely to that from the canton Soleure, so far as the genitalia are concerned, but no information is available concerning its general facies. Several specimens from this locality were found to have no uncus at all, so that the existence of a strong strain of exerge *helvetica* Rühl in that locality cannot be questioned. Hormuzaki stated that in other localities in that district he found perfect strains of exerge *athalia* (Rottemburg).

(xxviii) **MELITAEA ATHALIA** Rottemburg race **MIXTALPICOLA** race n.

Pl. 3, fig. 75 ♂ (type).

This is the very mixed race which occurs in the Engadine, which (as I have shown when dealing with race *helvetica* Rühl) has been found by Higgins and Beuret to consist (at Pontresina) of a mixture of race *helvetica* Rühl (as it exists to the north-west in the Davos and Albula valleys) of exerge *helvetica* Rühl and of race *orientalpicola* Verity (which occurs farther to the east in the Carnic Alps), the most alpine of the races of exerge *athalia* (Rottemburg). As

might be expected, therefore, race *mixtalpicola* Verity consists predominantly of synexerges of these two races. Higgins, in particular, found that the two races were represented in almost equal proportions. The holotype of this race, a male in the Verity collection, was taken at Pontresina (Canton Grisons) at an elevation of 2000 m.

(xxix) *M. ATHALIA* Rottemburg race *DELMINIA* Frühstorfer.

Pl. 4, figs. 78 ♂, 79 ♀; Genitalia pl. 11, fig. 279.

Melitaea athalia delminia Frühstorfer, 1910, *Soc. ent.* **25** : 51; *Melitaea athalia* Rottemburg var. *teriolensis* Weymer, 1912, *Verh. zool.-bot. Ges. Wien* **62** : (210).

In his original description of this race, Frühstorfer explicitly stated that the type specimen was taken at Meran, though at that time he included in this race the individuals found not only at Klausen and in the Südtirol (Alto Adige) but also on the Simplon and in the Val de Cogne. The two latter localities he, however, omitted entirely when he mentioned this race in his short paper on this species published in 1919. The features which he pointed out are the much richer, reddish-brown ground-colour (of which there is a broad space across all the middle of the wings) and the much lesser black suffusion at the base of the hind-wings than in the Northern races of *athalia* (Rottemburg). Beuret has examined the genitalia of several specimens from the Upper Adige and has found that one, labelled simply " Etschtal," was perfectly typical of *helvetica* Rühl; others from the Valvenosta and Laces were partly true *athalia* (Rottemburg) and partly transitional in character, one being, on the whole, referable to *helvetica* Rühl, but with a long thin uncus. All those from the " Schnalsertal " were the so-called " presumable hybrids." The Upper Adige, thus, seems to be the region where the strains of true *athalia* Rottemburg from the east and north have met strains of *helvetica* Rühl from the west and south, which have held their ground to a certain extent, although the former has secured the preponderancy in that basin.

In 1910, Weymer renamed this race *teriolensis* Weymer from specimens taken in the " Tirol." This name is of course nothing but a synonym of *delminia* Frühstorfer.

It will, no doubt, be useful to erect the name **Melitaea athalia** Rottemburg (? race *delminia* Frühstorfer) form **pseudodelminia** form. n. for the form which has the facies of *delminia* Frühstorfer, in general, coupled with fully characterised *helvetica*-like genitalia, whether it be constant and racial in some localities of that region, or only a more or less frequent individual form.

(xxx) **MELITAEA ATHALIA** Rottemburg race **BENACENSIS** race n.

Pl. 4, figs. 80 ♂, 81 ♀; Genitalia pl. 11, fig. 280.

This race, which is characterised by its extreme " dry " nature, replaces race *melida* Frühstorfer on Mount Baldo on the eastern side of the Lake of Garda, the latter race being confined to the more western Prealps. Not only does race *benacensis* Verity differ from race *melida* Frühstorfer in having the same genital armature as race *delminia* Frühstorfer, with a well-developed uncus, but it is separated also from that race by its much larger size (average length of fore-wing 20–21 mm. in the male and 22–24 mm. in the female as compared with 20 mm.), the broader and rounder wings, the more constantly pale fulvous of the ground-colour, and by the reduction of the black markings. It can, in

fact, be regarded as a giant version of race *delminia* Frühstorfer, in which the principal features of the latter (the paleness of the fulvous and the great reduction of the black bands on both surfaces) are much more accentuated than they are in more northerly localities, even in the most extreme examples. In the male the inner submarginal band is often entirely obliterated on the upper surface, with the result that there is an extremely broad space of fulvous across the disc of all the wings.

The male holotype of this race, which is in the Verity collection, is labelled " Mount Baldo."

(xxxi) **MELITAEA ATHALIA** Rottemburg race **MICRODELMINIA** race n.

Pl. 4, figs. 82, 83 ♂♂.

This race exhibits those variations of race *delminia* Frühstorfer which are the exact opposite of those seen in race *benacensis* Verity described above. It may indeed be regarded as the somation of that race found in damp mountain localities. It is distinguished chiefly by its small size (average length of forewing 18–19 mm., as compared with 20 mm. in *delminia* Frühstorfer), by the heavier black pattern, and by a black suffusion (in most individuals) at the base of all the wings on the upperside.

Frühstorfer noticed the existence of this race and recorded having captured examples of it at Trafoi and Campiglio.

The male holotype of this race, which is in the Verity collection, was collected by myself on the Mendola Pass at an elevation of 1500 m. on the 21st July.

(xxxii) *MELITAEA ATHALIA* Rottemburg race *VIVIDIOR* Gouin.

Pl. 4, figs. 84, 85 ♂♂; form *postvividior* Verity 86 ♂; Genitalia pl. 11, figs. 281–283.

Melitaea athalia Rottemburg var. *vividior* Gouin, 1922, *Act. Soc. linn. Bordeaux* **74** : 28 (as separate also under title "*Cat. Lep. Gironde*"); *Melitaea athalia* Rottemburg race *vividior* Gen. II *postvividior* Verity, 1930, *Ent. Rec.* **42** : 132.

This race, the name of which is often incorrectly attributed to Lhomme, was described from specimens taken at Sauros and Bazadars in the Gironde. Reverdin laid particular stress on having found a specimen with perfectly characterised *helvetica*-like genitalia amongst several examples from St. Côme, which latter had, on the contrary, the genitalia of true *athalia* (Rottemburg). If it be added that the general facies is also strikingly different from the usual one of central Europe, by its larger size, very much richer and brighter fulvous colour, and bolder pattern on both surfaces, recalling in a general way the finest races of *helvetica* Rühl, one might well have suspected that the entire race was made up of synexerges, although with a strong predominance of the strain of true *athalia* (Rottemburg). I suggested this in 1930 (*loc. cit.*), but in order to obtain further evidence, I asked the Directors of the Geneva Museum to allow me to examine the preparations made by Reverdin, which are preserved in that Institution. On receipt of these preparations, I found that the evidence so afforded supported my hypothesis very well, for the genitalia prepared by Reverdin varied very much and each differed in some way from the typical aspect of true *athalia* (Rottemburg). It will be seen, for instance, from the three figures which I reproduce that one (fig. 281) has an uncus quite typical of true *athalia* (Rottemburg), but a terminal process of the long thin type, with only a few large spines and no " plateau." In the other two specimens (figs. 282 and

283) the terminal process is the same as in true *athalia* (Rottemburg) but the uncus is thin, long and straight, characteristic of the more Eastern races and of those obviously transitional to *helvetica* Rühl. The other Gironde preparations before me show the same feature.

The second generation of this race, which I have named form *postvividior* Verity, is distinguished by its much smaller size (average length of fore-wing 18–20 mm. in the male and 24–25 mm. in the female, as compared with 20–22 mm. in the male and 24 mm. in the female) and by the duller tone of the ground-colour.

SECTION III.—Exerge *athalia* Rottemburg.[8]

I have already explained that the characters which distinguish exerge *athalia* (Rottemburg) from exerge *helvetica* Rühl (= *pseudathalia* Reverdin) are afforded almost exclusively by the male genital armature. That structure in exerge *athalia* Rottemburg exhibits the following characters :

A constantly well-developed uncus; usually a tegumen which lengthens into a trapezoid shape and has a much larger surface than the crescentic one exhibited by *helvetica* Rühl; the lateral process or harpe of valves not elbowed, but curved evenly, shorter, thicker and with teeth only on its basal two-thirds; the terminal process broader and shorter and usually very much so, on account of the so-called "plateau," which carries its fore-edge outwards in its basal half, its edge in such cases exhibiting numerous small teeth.

It has already been seen that this exerge divides very naturally into two groups of races, one of which is characterised by a thin uncus and the other by a thicker uncus, and I have discussed at length their presumed relationship and position both in the present-day and in their past history. One must now examine their various races in order to see how they are made up. Unfortunately I do not feel that I am adequately equipped to do this in anything like an exhaustive and definitive way. I can only make a rough attempt on general lines, which will have to be completed and corrected when it has been possible to examine a far larger number of preparations of specimens taken in all sorts of localities which are at present unknown in different parts of the vast territory inhabited by this exerge, which occurs from the eastern end of Siberia to the Atlantic, and when more individuals have been examined also from each of the known localities, so as to establish which are the features which are characteristic of the various races concerned and which are merely individual. Features of the latter kind may easily lead one wrong when only one or two specimens have been examined.

The present paper is concerned only with the racial (and to a lesser extent with the seasonal) variation of the species concerned; and I have therefore, in general, omitted to notice names given to individual forms only. There are, however, certain of these names which have been listed in catalogues and lists by other authors as racial names; and it is, therefore, worth noting that the undermentioned names represent individual forms only, of which account need not be taken in a study of the racial variation of the group :—

Melitaca athalia Rottemburg form *pseudaurelia* Ebert, 1926, *Deuts. ent. Z. Iris* **40** : 30 "Plateau v. Erzgebirge."

Melitaea athalia Rottemburg form *funesta* Stauder, 1922, *Ent. Anz.* **2** : 32 "Lainautal."

[8] For Section II, see p. 624.

Melitaea athalia Rottemburg form *permixta* Stauder, 1922, *Ent. Anz.* **2**: 33 " Laibach."

(a) Group of races of exerge *athalia* (Rottemburg) in which the male genital armature is characterised by the presence of a slender uncus.[9]

In the following group of races and forms the male genital armature is characterised by the presence of long slender processes to the uncus. These are either rod-like or, sharply pointed at the apex, not turned in towards each other. As a rule this type of uncus is accompanied by a comparatively thin and long terminal process of the valves, bearing few teeth or spines along its edges, but at least one on its anterior edge which distinguishes it from those of *M. deione* (Geyer) and of exerge *helvetica* Rühl of *M. athalia* (Rottemburg), which it would otherwise resemble to a certain extent in some of the more extreme individual forms.

This group exhibits a phenomenon of variation which is worthy of particular attention, because it seems to be of a different nature from the more usual changes of aspect in *athalia* (Rottemburg). This phenomenon appears to exist only in Eastern Central Europe, never having been observed even individually in specimens from the more western regions. Its most striking and most characteristic feature, which can also be considered its first degree, consists in a transformation of the more usual *athalia* pattern on the underside of the hind-wing into the one which usually distinguished *M. parthenoides* Keferstein (= *parthenie* Borkhausen, auct. *nec* Borkhausen) from *M. athalia* (Rottemburg) and which corresponds broadly also to that of *M. deione* (Geyer) and *M. arcesia* (Bremer). I describe it below when dealing with race *anatolica* Wagner, in which it is constant and racial and is accompanied by the second degree of this phenomenon, which consists in the change of the underside of the fore-wing, also in a *parthenoides*-like direction, never seen in most other races of *athalia* Rottemburg. I shall show later that the first degree without the second is constant in race *dejonides* Wagner from southern Russia and Rumania. It is produced also in most examples of race *lachares* Frühstorfer from the Baltic coast region and Scandinavia, although this race belongs, so far as the few specimens examined have shown, from the genitalia point of view, to the next group, with a thick uncus. This makes one suspect that it may be of mixed, post-Glacial origin, like the races of the Balkans, and that individuals with a slender uncus may be found to occur in it, as they do there. It will presently be seen that in Anatolia and in some examples from the mountains of Macedonia and Bulgaria the highest degree of this variation is reached in that a third feature is added to the two first others. This third feature is afforded by the upperside black pattern, which is thick in the outer part of the wing, so that the marginal and outer premarginal bands are blended into one with no, or very few and small, fulvous spaces left between them, whereas all the rest of the pattern contrasts with them by being very thin and partly obliterated.

The insect which Hormuzaki named *Melitaea athalia* Rottemburg var. *parthenopsis* Hormuzaki (1925, *N. Beitr. syst. InsektenK.* **3**: 71), which was described from a meadow with a southern exposure, on the Ahorn hill (Calvarienberg), near Ischl, in the extreme western Alps of Upper Austria, and subsequently found again at Hadad, in Transylvania, evidently stands very close to the variation described above, as it is said to be most exactly like *M. parthenoides* Keferstein, with a very thick black pattern, and to be not at all

[9] For Group (b), see p. 637.

like *athalia* Rottemburg. What Hormuzaki, however, laid particular stress on is that the genitalia are of the *athalia*-type and not that of *M. parthenoides* Keferstein. They are, however, very abnormal. Hormuzaki gave two figures of them and stated that all the specimens which he had examined afforded the same aspect. The two processes of the uncus are long and thin, but always asymmetric, one being much shorter than the other; they are also irregular in shape; the harpe has no teeth at all; the terminal process has a thick angle, instead of the usual spine seen in *M. athalia* (Rottemburg), on its lower edge. Other characters mentioned by Hormuzaki in 1934 (*Bulet. Facult. Stiinti Cernauti* **8**: 1–67) all point to the same conclusion, namely that this is an aberrant form which can be accounted for by the fact that all these specimens were collected in May before the normal time of emergence of *athalia* Rottemburg. This association of incomplete development with a general *parthenoides*-like facies must be taken into account in interpreting the origin of the latter also in those cases mentioned above, in which the genitalia are perfectly normal and simply belong to the type with a long slender uncus. That facies may in these cases be due to a slight degree of incomplete development produced, for instance, by drought associated with heat, in the case of races *anatolica* Wagner and *dejonides* Wagner, or with cold, in that of race *lachares* Fruhstorfer, acting on the special kind of constitution which is revealed by that kind of uncus and which does not seem, as explained above, to exist in western Europe, where that form of uncus is seen only in the synergic races.

(α) Asiatic race.[10]

(xxxiii) *MELITAEA ATHALIA* Rottemburg race *ANATOLICA* Wagner.

Pl. 4, fig. 87 ♂; Genitalia pl. 11, figs. 284 (same specimen as that illustrated on fig. 87 referred to above), 285.

Melitaea athalia anatolica Wagner, 1929, *Mitt. münchn. ent. Ges.* **19**: 22 pl. 2 figs. 1, 2 ♂ (false 3, 4).

This race was described from specimens taken on the Sultan-Dagh in Inner Anatolia at an elevation of 1500 m. It is represented in my collection by paratypes received from Wagner. This is probably the race recorded by Staudinger as occurring at Amasia and Tokat and also the one of the Alem-Dagh on the asiatic side of the Bosphorus the genitalia of specimens of which Reverdin mounted. I figure one of the two specimens very kindly sent me on loan by the Geneva Museum, and it will be noticed that the genitalia are exactly similar to those of the paratype of race *anatolica* Wagner in my collection. These examples seem to show a notable constancy of structure as compared with the great variability of other races and especially of those from the Balkans. The processes of the uncus are to the highest degree of the long and slender type (a little shorter and less sharp at the apex in the third specimen mentioned, but very straight). The terminal process is also long and thick, but with one, sometimes double, tooth on its anterior edge, which distinguishes it from that seen in races of exerge *helvetica* Rühl. The harpe is distinctly of the shape of *athalia* (Rottemburg) and not of that of *helvetica* Rühl. The general facies of this insect is most remarkable, because it belongs to the particular type which I have already mentioned above as proper to some East European races of *athalia* (Rottemburg), but never occurring even individually in the more western races. As I have shown, its chief feature consists in a striking resemblance of the

[10] For sub-section (β), see p. 632.

entire wing pattern of the underside of the hind-wing to that of *M. parthenoides* Keferstein and *M. deione* (Geyer)—as well as that of *M. arcesia* Bremer—by its sharpness, hardness, regularity and invariability, as compared with that of the other form of *athalia* (Rottemburg). The black streaks being rather thick make it look more especially like race *rondoui* Oberthür. The russet spots are large and of a clear tone of colour. The underside of the fore-wing is peculiar also, since the entire black pattern is obliterated or replaced by a few capillary streaks, as happens very often in *M. parthenoides* Keferstein and constantly in *M. arcesia* Bremer, but never in other *M. athalia* (Rottemburg). The pre-marginal arches which are still visible are flat and rounded, so that the yellow surface between them and the margin is very much reduced, whilst the arch between the third medial and the first cubital nervure is higher than the rest as it is in *athalia* Rottemburg, this distinction constituting perhaps the best character by which to separate most specimens of this race of *M. athalia* (Rottemburg) from *M. parthenoides* Keferstein and from *M. parthenie* (Borkhausen) (= *aurelia* Nickerl). Finally, on the upperside of the wings the outer pre-marginal and the marginal black bands are in race *anatolica* Wagner so thick that they blend into one broad marginal band, whereas all the rest of the pattern contrasts with them by its thinness.

(β) European races.[11]

(xxxiv) *MELITAEA ATHALIA* Rottemburg race *DEJONIDES* Wagner.
Pl. 4, fig. 88 ♂.

Melitaea athalia dejonides Wagner, 1918, *Z. österr. ent. Ver.* **3** : 12.

This is a striking little race which recalls *M. deione* (Geyer) to a high degree by its general appearance, since it is of a light bright fulvous and has a very thick black pattern, including the marginal bands which are very much reduced by the fulvous lunules. Moreover, the underside has the *deione* pattern described in *anatolica* Wagner, but here the black streaks are very thin, increasing the similarity to *M. deione* (Geyer). This race, which is evidently a product of very dry and hot surroundings, has been described from Rumania (Pd. Barac near Hatcaran, in the Prahova district; collected in the second half of May). The specimen, which I figure, is in my collection and agrees exactly with Wagner's description. It is labelled "Southern Russia." Its genitalia were examined by Reverdin, who labelled the specimen "*athalia*", but, very unfortunately, his preparation (N. 6676) is no longer to be found amongst those preserved in the Geneva Museum.

(xxxv) *MELITAEA ATHALIA* Rottemburg race *FIORII* Rocci.
Pl. 4, figs. 89 ♂, 90 ♀; Genitalia pl. 11, fig. 286.

Melitaea athalia Rottemburg form (razza) *fiorii* Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 205.

This race is practically identical with *dejonides* Wagner, though small local differences may be detected when an adequate series of the latter is compared with it. The types are from Palmanova, in the province of Udine, and this race spreads presumably to the greater part of the lowlands of Venetia. Its geographical proximity to race *tenuis* Verity, of exerge *helvetica* Rühl of peninsular Italy, necessarily recalls the almost identical outward appearance of the

[11] For sub-section (α), see p. 631.

two insects, but Rocci has examined the male genital armature of several specimens and has invariably found them to be referable to exerge *athalia* (Rottemburg). Moreover, *tenuis* Verity in many examples is much more variable and much less *deione*-like than is race *fiorii* Rocci.

(xxxvi) **MELITAEA ATHALIA** Rottemburg race **ORIENTALPICOLA** race n.

Pl. 4, figs. 91, 92 ♂♂, 93 ♀; Genitalia pl. 11, fig. 287 (same specimen as that illustrated on fig. 91 referred to above).

On examining the genital armature of a large series of specimens collected by myself at Sappada, 1400 m., on the southern Italian watershed of the Carnic Alps, I was interested to find that these specimens are referable to exerge *athalia* (Rottemburg), and not to exerge *helvetica* Rühl or to transitions of it such as the alpine race of high altitudes found farther west beyond the Adige basin. This corresponds with my conclusion in regard to the alpine race *orientalpestris* Verity of *M. diamina* (Lang) (= *dictynna* Esper) of that region, which belongs to the Central exerge and is found from the Adige westwards. From the Carnic Alps, race *orientalpicola* Verity seems widespread eastward and northward, across Carinthia, from which district I have examples, for instance, from Huutenberg, in the South Styrian Alps, and from Mallnitz, in the Hohe Tauern. To the naked eye this race is of the same size and general appearance as race *helvetica* Rühl of equivalent altitudes in the Grisons, but the black pattern is more extensive, as also is the basal suffusion. Moreover, there are no individuals in which this suffusion is as reduced as in many of the specimens from the Grisons, such as I have from Filisur and from Hofberg. In the latter localities, when this suffusion is extensive, it contrasts with the thin pattern of the outer part of the wing in a way never seen in race *orientalpicola* Verity, where also the latter is thick. In my series from Sappada twenty per cent. of the specimens reach so high a degree of melanism that they might well be mistaken for *M. diamina* (Lang) on the upperside, the hindwings being entirely black, with only a premarginal row of fulvous spaces. These individuals thus point to the following darker races found farther north. Race *orientalpicola* Verity is somewhat intermediate between race *fiorii* Rocci and these darker northern races, both by its aspect and by reason of its geographical position.

The male holotype of this race, which is in the Verity collection, is labelled " Sappada, m. 1400."

(xxxvii) *MELITAEA ATHALIA* Rottemburg race *PSEUDODICTYNNA* Stauder.

Melitaea athalia Rottemburg form or ssp. *pseudodictynna* Stauder, 1922, *Ent. Anz.* **2** : 31.

Broadly speaking, this race falls under race *suessula* Frühstorfer, and it is unfortunate that Stauder did not compare the two races in his original description and point out in what respect they differ from one another. The race was described by Frühstorfer under the above name from specimens taken on the moors of Upper Bavaria, but in 1917 he stated that the race of *athalia* (Rottemburg) from the Alps of Lower Austria, of Styria and of Moravia stand in close connection with it. Since race *pseudodictynna* Stauder was described from specimens taken at Hallstaetter in Salzkammergut, its type locality lies between the regions specified by Frühstorfer. Moreover, Stauder's description

of this race, a highly melanic one closely resembling *M. dictynna* (Esper) (i.e. *diamina* Lang), practically corresponds with the description given to race *suessula* Frühstorfer by its own author. Nevertheless in view of the fact that Frühstorfer originally and explicitly selected the race from Rohrseemoos on the Kchel See, in Upper Bavaria, as typical of race *suessula* Frühstorfer, and stated that it was usually much smaller than race *helvetica* Rühl from the Engadine, and that it had tiny round spaces like dots all over the entirely black wings, there is no doubt that this is a particular local form, only found individually in the other regions mentioned above. One can therefore very well restrict the name of race *suessula* Frühstorfer to this form. The name *pseudodictynna* Stauder can therefore be used for the more usual forms and for the race as a whole found in these Northern Alps.

(xxxviii) *MELITAEA ATHALIA* Rottemburg race *SUESSULA* Frühstorfer.

Pl. 9, figs. 237, 238 ♂♂.

Melitaea athalia suessula Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 4.

The name *suessula* Frühstorfer appears to be the proper designation for the dwarf and melanistic race found on the moors in Upper Bavaria. Frühstorfer's own preparation of the male genital armature (now in the Paris Museum) exhibits an uncus consisting of two thin and straight points, thus clearly establishing the clear relationship between this race and race *orientalpicola* Verity. A common eastern origin for both races is suggested by this structure.

[If it were established that *Melitaea athalia* Rottemburg var. *parthenopsis* Hormuzaki, 1925, discussed on p. 630 above, were a race possessing fixed hereditary factors, reproducing its special peculiarities from generation to generation, the present would be the appropriate point at which to insert it in a linear arrangement of the races of this species.]

(xxxix) *MELITAEA ATHALIA* Rottemburg race *PARTHENOIDEMIMA* Verity.

Pl. 4, figs. 94, 95 ♂♂; Genitalia pl. 11, fig. 288 (same specimen as that illustrated on fig. 94 referred to above).

Melitaea athalia Rottemburg race *parthenoidemima* Verity, 1939, *Ent. Rec.* **51** (Suppl.) : (18).

The types of this race (now in the Verity collection) were collected in western Bulgaria, Rilo Dagh, Kyrilowa Pal. (1500 m.) by Züllich between 18th and 28th June; paratypes were taken on Mont. Rilski (1200 m.) from 17th July to 2nd August and on Mount Olympus in Macedonia at Prionia (1500 m.) and Skala (300 m.). A large percentage of these specimens, including nearly all those from Prionia, might easily be mistaken for a race of *M. parthenoides* Keferstein on account of the underside pattern of the hind-wing, the obliteration of the black markings of the fore-wing on that surface, and the even and low premarginal arches, all precisely as in race *anatolica* Wagner, whilst on the upperside a very broad black marginal band is accompanied by bands less thick and often partially obliterated on the rest of the wing and not so sharp in outline as in the latter race. Other characteristics of this race are as follows: size larger and sometimes enormous; fulvous colour richer and warmer, as in *limera* Frühstorfer, to whom the rest of the specimens before me from the above localities could be referred, some being distinctly transitional

also as regards the underside pattern, just as it happens in race *lachares* Frühstorfer, to which this race is evidently connected by the duality of its aspect. It will be seen by the two figures (288) that the genitalia also exhibit duality and range from the type having a long slender uncus in the highest degree to that having the short one and longer tegumen. They are, however, in both cases perfectly normal and are distinctly different from the peculiar aberrating structures seen in *parthenopsis* Hormuzaki.

(xl) *MELITAEA ATHALIA* Rottemburg race *LIMERA* Frühstorfer.

Pl. 9, figs. 229, 230 ♂♂, 231, 232 ♀♀; pl. 4, figs. 95 *bis*, 97 ♂♂, 96, 98 ♀♀; Genitalia pl. 11, fig. 289 (same specimen as that illustrated on fig. 95 *bis* referred to above).

Melitaea athalia limera Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 3.

This race was described from Koricna in Bosnia, and is the dark mountain representative of *scardona* Frühstorfer. No doubt it is as widespread as the latter in the western part of the northern Balkans in the region from the Adriatic to Bulgaria. In aspect it varies both individually and locally from that of *scardona* Frühstorfer to an extreme melanistic form, which becomes predominant in some localities, so much so that it can be treated as a different race. The typical form of *limera* Frühstorfer is intermediate between these extremes and can be described as exhibiting a black pattern of uniform but moderate thickness all over the wings on the upperside, thus producing a regular network of black markings somewhat recalling that seen in *M. parthenie* (Borkhausen) (= *aurelia* Esper) on a ground of a rich reddish fulvous, as figured in the Supplement to Seitz's *Grossschmett. Erde* (pl. 13, fig. G 3).

From some points of view it might be possible to regard *parthenoidemima* Verity and *limera* Frühstorfer as forms of a single race. In that event, the collective race should be known by the name *limera* Frühstorfer, the name *parthenoidemima* Verity becoming in that event the name for the *parthenoides*-like form of the race.

(xli) **MELITAEA ATHALIA** Rottemburg race **DIAMINOIDES** nom. n.

Pl. 4, figs. 99, 100 ♂♂, 101 ♀; Genitalia pl. 12, figs. 290 (same specimen as that illustrated on fig. 100 referred to above), 291, 292 (same specimen as that illustrated on fig. 99 referred to above).

I propose the above name as a nom. nov. pro *Melitaea athalia dictynnoides* Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 4 (also *id.*, 1919, *ibid.* **83** (A) (3) : 181), which is invalid, because it is a homonym of *Melitaea aurelia* Nickerl var. *dictynnoides* Hormuzaki, 1898, *Deuts. ent. Z. Iris* **11** : 2.

This name is applicable to the race of the Balkans found in Transylvania, the Bukowina, part of Herzegovina (Vucijabara, from which locality there are specimens in the Verity collection), and Galicia (Lemberg), although together with the individuals in which the hind-wings on the upperside are entirely black, there are others resembling, according to the locality in question, either race *limera* Frühstorfer or race *scardona* Frühstorfer. As can be seen from the figure (pl. 4, fig. 99) of the genitalia of a highly characterised specimen of race *diaminoides* Verity from Herzegovina, forms of those organs transitional to the following type with a shorter and thicker uncus exist at least in some regions, notwithstanding the fact that the type with a very long and slender

uncus was found by Sheldon and Hormuzaki on examining specimens of *diaminoides* Verity. Hormuzaki indeed was almost prepared to look upon this feature as a specific distinction, so that it is to this form in particular that the name *diaminoides* Verity applies.

(xlii) *MELITAEA ATHALIA* Rottemburg race *LUCIFUGA* Frühstorfer.

Pl. 8, figs. 222–224 ♂♂; Genitalia pl. 12, fig. 293 (same specimen as that illustrated on fig. 222 referred to above).

Melitaea athalia lucifuga Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 4.

This race, which occurs at Saratoff on the Volga, was considered by Frühstorfer to be a transition between the European races and the Asiatic race *tinica*. Frühstorfer added that it was closely connected with *dictynnoides* Frühstorfer (*i.e. diaminoides* Verity) but was not identical with it, and that the smallness of the russet spots of the underside recalled *M. britomartis* Assmann, whilst the black streaks were all very thick. Judging from Frühstorfer's specimens in the Paris Museum, I should say that this race is on the whole a transition also to race *caucasogenita* Verity, and that many individuals of the two do not differ at all from each other when race *lucifuga* Frühstorfer reaches its highest degree of melanism. As a matter of fact, Frühstorfer himself, in his revision of the races of *M. athalia* (Rottemburg) published in 1919 (*Arch. Naturges.* **83** (A) (3) : 182), did not mention *caucasica* Staudinger at all, but extended the area of *lucifuga* Frühstorfer to cover also the "Caucasus (Tiflis)." The genitalia of the two races are identical.

(xliii) *MELITAEA ATHALIA* Rottemburg race *CAUCASOGENITA* Verity.

Pl. 4, fig. 102 ♂; pl. 8, figs. 220 ♂, 221 ♀; pl. 9, figs. 240 ♂, 241 ♀; Genitalia pl. 12, figs. 294 (same specimen as that illustrated on fig. 220 referred to above), 295 (same specimen as that illustrated on figure 102 referred to above).

Melitaea athalia Rottemburg race *caucasogenita* Verity, 1930, *Ent. Rec.* **42** : 134, nom. nov. pro *Melitaea athalia* Rottemburg var. et ab. *caucasica* Staudinger, 1871, in Staudinger & Wocke, *Cat. Lep.* (ed. 2) : 19 (homonym of *Melitaea didyma* Ochsenheimer var. *caucasica* Staudinger, 1861, in Staudinger & Wocke, *Cat. Lep.* (ed. 1) : 8).

The way in which Staudinger introduced the name *caucasica* Staudinger is very curious. He described it in 1871 as having "the hind-wings nearly entirely black," with no other remark about it, and he gave Armenia as its locality, but with a mark of interrogation. In the 1901 edition (p. 32) he added that it might be a large variety of *M. aurelia* Nickerl, and he gave no locality for this race, though he mentioned southern Armenia amongst those of *M. athalia* (Rottemburg) in general. Evidently he never obtained any definitive proof that a race exhibiting that feature constantly existed either in the Caucasus (as the name that he had given seemed to indicate) or in Armenia, which is a very different region. I have found no further information in the work of any other author. Spüler and Berge ruled out the name entirely. Tutt and Seitz treated it as an individual aberration, with black hind-wings, obtained in any locality. Rühl alone quoted it as a "var." from the Caucasus, but, to be exact, this statement appears in the portion of the book published by Heyne. In point of fact Heyne did possess direct evidence to go by, because in his collection, now preserved in the Paris Museum, there exist several specimens of a highly melanistic race of *M. athalia* (Rottemburg) labelled : "var. *caucasica*; Caucasus."

I here figure two pairs from Heyne's series. One of these pairs, however, had actually been separated from the rest and placed in the series of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), presumably on account of its small size. It will be seen that the genitalia of the male are, however, perfectly characteristic of *M. athalia* (Rottemburg). They only differ from those of the larger couple in that the uncus is of the long, straight and slender type, whereas that of the former is just as in western races of true *M. athalia* (Rottemburg). I have also found one male and three females labelled " Caucasus " in the collection very kindly sent to me on loan by the Hamburgisches Zoologisches Museum, which agree exactly with those in the Heyne collection. It can, therefore, be considered quite certain that there exists a very black race in the Caucasus which presumably is also the race of the localities of Transcaucasia recorded by Romanoff (1884, *Mém. Lép.* **1** : 57).

I must here add that I possess a male labelled " B. Altai, June 82," sent to me by Bang-Haas, which is certainly *caucasogenita* Verity. I give a figure both of this specimen (pl. 4, fig. 102) and of its genital armature (pl. 12, fig. 295). The latter are exactly like those of the large couple from the Caucasus mentioned above, *i.e.* like true *M. athalia* (Rottemburg). This shows that in the Altai Mountains this species exists together with *M. ambigua* Ménétriés, which I have dealt with already, although neither species has hitherto been recorded from these mountains.

I should now add that those who prefer " lumping " names might with a certain amount of reason argue that the name *lucifuga* Frühstorfer might readily replace both the homonym *caucasica* Staudinger and the so-called *dictynnoides* Hormuzaki (*i.e. diaminoides* Verity), since these three insects are very closely connected with one another, and mix in some populations as individual forms. On the other hand, populations from regions so very different and distant from each other can scarcely be exactly the same; even a superficial judgment shows that these populations represent at least three different stages of melanism. In race *diaminoides* Verity from the Balkans a large proportion of individuals consists of *limera*-like individuals and transitions to it; in race *lucifuga* Frühstorfer there still occur a considerable number with fulvous spaces all over the wings, as shown by the specimen (a paratype) which I figure (pl. 8, fig. 224). In race *caucasogenita* Verity melanism reaches a higher average degree, although Frühstorfer, who did not know this form, unfortunately selected the individual form most like it as the type of race *lucifuga* Frühstorfer and laid stress on the melanism of the latter in his original description. The genitalia of these races seem to agree with one another, but vary considerably in that they exhibit the type with a thin uncus as well as that with a thick uncus, whereas in the following western races the former type of uncus is apparently never produced.

(b) Group of races of exerge *athalia* Rottemburg in which the male genital armature is characterised by the presence of a thick uncus.[12]

This group contains those races and forms in which the processes of the uncus are on the average not so long as in those races and forms included in the preceding group. Moreover, in this group, these processes are always thicker at the base and taper into a sharp point, which is usually bent inwards at the apex, so that the two produce together the effect of the mandibles of some species of Coleoptera. As a rule, this type of uncus is accompanied by a broader and

[12] For Group (a), see p. 630.

often shorter terminal process of the valves, with a very large spine on its anterior edge, or, still more characteristically, with a wide broadening in place of it, and minute teeth on the terminal edge of it, called plateau by Reverdin. All these features point to those of *M. britomartis* Assmann, in which they are still more accentuated, whereas the opposite features characteristic of the other group point to *M. ambigua* Ménétriés and *M. deione* (Geyer), so that the enormously more variable *M. athalia* (Rottemburg) stands somewhat as a connecting link between them.

Even within the limits of this western group, with a thick uncus, I have shown when classifying the subdivisions of this species in general that one could conveniently make a distinction between those races and forms which have a comparatively long uncus and those which have an extremely short, very thick and stumpy one, in which also the terminal process is quite unusually broad and short, just as it is in many races of *M. britomartis* Assmann, a feature which may usually be taken as distinguishing the last-named species from *M. athalia* (Rottemburg).

(1) Sub-group in which the male genital armature is characterised by the presence of a comparatively long uncus.[13]

(α) Asiatic race.[14]

There is an extraordinary lack of knowledge regarding the distribution—and indeed the occurrence—of exerge *athalia* (Rottemburg) in central Asia and "eastern Siberia." In the former region it would appear not to exist at all, were it not for the record of Samarkand given by Rühl (drawn from some source which I have not been able to trace) and for a single female specimen labelled "Kultscha" in the Hamburgisches Zoologisches Museum, which is more or less similar to race *tinica* Frühstorfer. From western Siberia I know only of Suschkin's specimens from the Tarbagatai and from the southern Ural mountains, the genitalia of which are those of exerge *athalia* (Rottemburg).

I am therefore for the present only acquainted with one race of exerge *athalia* (Rottemburg) in eastern Siberia, and its range still remains to be determined on the strength of exact diagnosis made by the male genital armature, for all the records and the remarks of the past are worthless owing to the tremendous confusion which has hitherto existed between this species and *M. ambigua* Ménétriés, and *M. britomartis* Assmann, apart from supposed specimens of *M. aurelia* Nickerl (*i.e.* of *M. parthenie* (Borkhausen)) and of *M. parthenie* Borkhausen, auct. *nec* Borkhausen (*i.e.* of *M. parthenoides* Keferstein), both of which species must be totally ruled out from the number of Asiatic species. As things stand to-day, this Asiatic race of *M. athalia* (Rottemburg) is only known from the neighbourhood of Irkutsk, whence Frühstorfer described it in 1910. Staudinger's statement (1892, *in* Romanoff, *Mém. Lép.* **6** : 186) that specimens of *M. athalia* (Rottemburg) taken at the mouth of the Amur fully agree with European specimens, cannot be accepted, according to the knowledge since acquired, for in that region only nominotypical *M. ambigua* Ménétriés is known to exist. One now knows the insect in question to be as distinct as ordinary *M. ambigua* Ménétriés, whereas Staudinger said that he considered that Ménétriés's figure was drawn from an aberrant specimen of true *M. athalia* (Rottemburg), thus showing that he had not grasped the racial and *ambigua*-like features which are to be seen in all the specimens from the mouth of the Amur.

[13] For sub-group (2), see p. 644. [14] For sub-section (β), see p. 639.

(xliv) *MELITAEA ATHALIA* Rottemburg race *TINICA* Frühstorfer.

Pl. 8, figs. 210 (type), 211 ♂♂, 212 ♀; Genitalia pl. 12, fig. 296 (same specimen as that illustrated on fig. 211 referred to above).

Melitaea athalia tinica Frühstorfer, 24th Sept. 1910, *Soc. ent.* **25** : 51; *id.*, 1st Oct. 1910, *Ent. Z.* **24** : 144.

This race was described from six males taken at Irkutsk, but in Frühstorfer's collection, now in the Paris Museum, this race is represented by a larger number of specimens, some of which must therefore have been added at a later date. The female—which was unknown at the time when this race was first described—is also represented in the series now in the Frühstorfer collection. I figure the type (pl. 8, fig. 210) and a female (pl. 8, fig. 212), together with a paratype (pl. 8, fig. 211), the male genital armature of which is also figured. In the Paris Museum there is also a very large series of specimens from Irkutsk, collected by J. Chaffangon, in June 1896, which quite agrees with the preceding in general facies, as well as by the genitalia. I figure (pl. 12, fig. 296) the genitalia of one of the specimens kindly presented to me by M. Le Cerf. Frühstorfer rightly described the upperside of race *tinica* Frühstorfer as transitional to that of race *caucasica* Staudinger (*i.e. caucasogenita* Verity) and to race *dictynnoides* Hormuzaki, auct. *nec* Hormuzaki (*i.e. diaminoides* Verity) by the extent of the black pattern, which is of less extent on the fore-wing, thus recalling race *scardona* Frühstorfer, but covers nearly the whole hind-wing, except for a row of large premarginal spaces of a deep fulvous colour. Also on the underside the black spotting is less than in race *caucasogenita* Verity on the fore-wing, but the streaks of the hind-wing are very thick, including those which encircle the row of small silvery-white spaces, which cross the disc. The premarginal russet spots are remarkably large and of a deep reddish tone. These two last features (small white spaces and large russet spots) somewhat recall the characteristics of *M. ambigua* Ménétriés in these respects and are worthy of notice because also in the genitalia the terminal process of the valves has very much the same shape as in *M. ambigua* Ménétriés, being narrower than in true *M. athalia* (Rottemburg), and having only two or three deeply indented spines. The other parts and the uncus leave, on the contrary, no doubt as to its proper position in this group of races.

(β) European races.[15]

(xlv) *MELITAEA ATHALIA* Rottemburg race *NORWEGICA* Aurivillius.

Pl. 5, figs. 103 ♂, 104 ♀; Genitalia pl. 12, fig. 298 (same as that illustrated on fig. 103 referred to above).

Melitaea athalia Rottemburg var. *norwegica* Aurivillius, 1888, *Nordens Fjärilar* : 30; *Melitaea aurelia* Nickerl var. *scandinavica* Staudinger, 1892, *Deuts. ent. Z. "Iris"* **5** : 327; *Melitaea athalia* Rottemburg ab. *fennica* Reuter, 1893, *Acta Soc. Faun. Flor. fenn.* **9** (6) : 14.

This race has for over half a century been regarded as being the central Norwegian race of *M. aurelia* Nickerl (*i.e.* of *M. parthenie* (Borkhausen)). According to Staudinger, it is the race also of Lapland, Livonia, and Estonia. Whether that species exists in any of those regions remains to be ascertained, but the typical insect of central Norway in the Staudinger collection, of which Herr Bang-Haas has sent me a couple of specimens on loan, has now turned out, on examination of the male genital armature, to be referable to *M. athalia*

[15] For sub-section (α), see p. 638.

(Rottemburg), and to be exactly similar in that respect to the nominotypical race. What had led entomologists wrong is evidently the very small size of this race as compared with the others of *M. athalia* (Rottemburg). This race is also of an unusually pale dull fulvous. The black pattern is thin and this is plainly visible on the outer half of the wings in both sexes, whereas the basal half is broadly covered by a black suffusion.

The original description of *fennica* Reuter sounds rather fantastic and incomprehensible at first, but specimens from the high Alps, such as the one I have from Ofenberg in the Grisons, show that there is such a form. It is presumably due to very cold but not particularly damp surroundings having impeded the regular development of the wing pattern. It is nothing but a form transitional to the more extreme aberration *pyronia* Hübner, more usually known as *corythalia* Hübner, a name given in reality to a form of *M. diamina* (Lang) (= *dictynna* Esper) and which Esper had already used for a totally different form of *M. phoebe* [Schiffermüller and Denis]. As a matter of fact, Reuter pointed out that on the upperside the black markings are very thin, except the marginal band, and that the russet bands of the basal half of the hind-wings on the underside are so broadened and blended together that they form an even surface of that colour. It remains to be seen if such a form is racially constant in some localities of Finland (where the usual race is *lachares* Frühstorfer), or whether it was described from an aberrant family.

(xlvi) *MELITAEA ATHALIA* Rottemburg race *LACHARES* Frühstorfer.

Pl. 8, figs. 225 ♂, 226 ♀; Genitalia pl. 12, fig. 297 (same specimen as that illustrated on fig. 225 referred to above).

Melitaea athalia lachares Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 178; *Melitaea athalia borealis* Lindstrom, 1929, *Ent. Tidskr.* **50** : 226; *id.*, 1930, *ibid.* **51** : 28.

When dealing with the Scandinavian species of the genus *Melitaea* Fabricius, Aurivillius (1888, *Nordens Fjarilar* : 29–30) referred to two belonging to the *athalia* group, namely :—

(*a*) an insect which he correctly identified as a race of *M. athalia* (Rottemburg), and which (as shown above) he named *M. athalia* Rottemburg var. *norwegica* Aurivillius;

(*b*) an insect which he identified with *M. parthenie* (Borkhausen), *i.e.* the insect universally so known both then and for many years later, the correct name for which is *M. parthenoides* Keferstein.

This latter insect remained incorrectly identified and unnamed until 1919, when Frühstorfer correctly associated it with *M. athalia* (Rottemburg) and named it subspecies *lachares* Frühstorfer. Lindstrom (1929) referred back to Aurivillius's paper, and, being under the impression that the second of the two insects referred to therein (*i.e.* that noted under (*b*) above) was still unnamed, put forward the name *borealis* Lindstrom as a "nom. n." for it. The name *borealis* Lindstrom is therefore nothing but a synonym of the name *lachares* Frühstorfer.

In his description of this race Frühstorfer mentioned the following localities : "Sweden, middle of July (Bryk leg.), neighbourhood of Stockholm, Norway, Finland (Helsingfors), Estonia." I figure the pair labelled "Type" in Frühstorfer's series. On comparing these specimens with my own collection I find that I possess a well-characterised series of specimens from St. Amata in Livonia. It is a very distinct race characterised as follows : size usually rather

small; fulvous pale; black markings of the upperside all well marked and of even size in both sexes, recalling *M. parthenoides* Keferstein on that surface; female more even in colour than is usual in *M. athalia* (Rottemburg). The most striking characteristic is, however, the underside, which is exactly similar to that of *M. parthenoides* Keferstein or of *M. deione* (Geyer) race *rondoui* Oberthür in both sexes owing to the thickness and sharpness of all the black streaks all over the hind-wing and the reduction of the silvery-white spaces which cross it to a row of small round spaces surrounded by a thick black ring. The black markings of the fore-wing are almost entirely obliterated in most females. In the male, however, this is not so, this sex resembling race *anatolica* Wagner. The premarginal arches, however, are low and even in both sexes. These *parthenoides*-like features are fully developed in about seventy per cent. of my males from St. Amata and in about sixty per cent. of my females. In the remainder either these features are only feebly indicated or the specimens are transitional to true *M. athalia* (Rottemburg) from northern Germany.

I have already mentioned that in Leningrad there exists a very varied, mixed race, exhibiting the characters both of race *lachares* Frühstorfer and of nominotypical *athalia* (Rottemburg). A few specimens which I have from Helsingfors are all similar to the largest and brightest examples of nominotypical *M. athalia* (Rottemburg) from Paris and central Europe and do not betray in any way their origin from the *lachares* region as broadly interpreted. There is therefore evidently a good deal of local variation within race *lachares* Frühstorfer. The genitalia of the " type " and specimens from Livonia agree exactly with one another and are like those of Parisian examples.

(xlvii) *MELITAEA ATHALIA* Rottemburg race *SCARDONA* Frühstorfer.

Pl. 8, fig. 227 ♂ (type); pl. 9, fig. 228 ♂; Genitalia pl. 12, figs. 299 (same specimen as that illustrated on fig. 227 referred to above), 300.

Melitaea athalia scardona Frühstorfer, 1910, *Soc. ent.* **25** : 51.

This race was originally described from Agram (*i.e.* Zagreb) in Croatia. Subsequently, Frühstorfer stated (1919, *Arch. Naturgesch.* **83** (A) (3) : 182) that it occurred also at Duzi in Herzegovina, at Lavrana in Istria, and in the neighbourhood of Laibach in Carniola; but no doubt it is very much more widespread towards the east in the northern Balkans, since (as observed by Frühstorfer) it is the intermediate form between the dark transylvanian race *diaminoides* Verity and the light-coloured race *mehadiensis* Gerhard. It can be regarded as a smaller, darker and more variable substitute for the latter race at low altitudes in the northern Balkans to the south of the range of the fully characterised race *mehadiensis* Gerhard, occurring there as a racially constant form. Thus race *scardona* Frühstorfer blends with race *mehadiensis* Gerhard gradually towards the north (*e.g.* at Trieste); and it blends with race *diaminoides* Verity at higher altitudes in its own region, producing the mountain race *limera* Frühstorfer with which I have already dealt. According to Frühstorfer's description (as summarised by himself in 1919), typical examples of race *scardona* Frühstorfer have a broad black marginal band on the hind-wings coupled with large spaces of bright reddish-yellow on the fore-wing, but it seems rather doubtful whether this particular form is prevalent enough to apply the name exclusively to it. Frühstorfer's own broader interpretation of its position seems to be a better standpoint. It has, as a matter of fact, already been adopted in practice by those who have made use of the name. Thus the figure given by Gaede (1930, *in* Seitz, *Grossschmett. Erde* **1** (Suppl.) pl. 13,

fig. G 2) shows none of the features just described and which may be seen in my figure of Frühstorfer's " type " and so labelled by him. Gaede's figure, which seems to represent a female, is more like Frühstorfer's paratype from Agram, here shown in pl. 9, fig. 228, and of the specimens in my collection from the Carso above Trieste, and from Vienna. It is the most usual form of the race.

The genitalia agree exactly with those of the nominotypical *M. athalia* (Rottemburg) from Paris. I figure those of the " type " which I have dissected (pl. 12, fig. 299) and those of a specimen from the Carso (pl. 12, fig. 300). They are quite similar to the genitalia of a topotype from Zagreb, figured by Reverdin in 1922 (*Bull. Soc. lép. Genève* **5** : pl. 2). Considering the way in which race *scardona* Frühstorfer intermixes with races *limera* Frühstorfer and *diaminoides* Verity, it is certain also that the genitalia of males of this race must often be mixed with the sort which has a slender uncus.

(xlviii) *MELITAEA ATHALIA* Rottemburg race *MEHADIENSIS* Gerhard.

Pl. 9, figs. 234, 235 ♂♂, 236 ♀; Genitalia pl. 12, fig. 301 (same specimen as that illustrated on fig. 234 referred to above).

Melitaea athalia Rottemburg ab. *mehadiensis* Gerhard, 1882, *Berlin. ent. Z.* **26** : 126; *Melitaea athalia* Rottemburg var. *pygmaea* Hormuzaki, 1923, *Z. wiss. InsektBiol.* **3** (*Beilage*) : 11.

This race was described from Mehadia in the extreme south of Hungary near the Rumanian frontier. It is, however, a widespread race. To the east, Hormuzaki has found it to be the representative of *M. athalia* (Rottemburg) as far as Bukowina and Galicia either racially in some localities, or mixed with race *diaminoides* Verity in others. To the south-east it extends as far as Mt. Olympus in Macedonia, where Querci found it racially at the foot of the mountain. To the west and south-west I have shown that it is found also as the most thinly marked individual form of race *scardona* Frühstorfer. Northward in Austria it turns into forms transitional, on the contrary, to the still more thinly marked nominotypical *M. athalia* (Rottemburg). The most highly characterised *mehadiensis* Gerhard is larger than average size specimens of nominotypical *M. athalia* (Rottemburg). Its wings have a peculiar shape, in that they are strikingly elongated as compared with the usual wing-shape of *M. athalia* (Rottemburg), the wings being more like those of *M. ambigua* Ménétriés in shape. The fulvous is on the average warmer and brighter in tone than in the Parisian race and in those of central Europe. The pattern is rather thicker and is much less variable in Hungary and in localities where the form is racially constant in its pure facies. Hormuzaki laid particular stress on the fact that the genitalia of race *mehadiensis* Gerhard afford a striking peculiarity in the terminal process, which is of enormous size, being both long and broad with a dentated plateau at its terminal end as well as the more usual one lower down on the fore-edge. The lower edge of the clasps is also markedly convex. He figured the genitalia in a paper published in 1911 (*Z. wiss. InsektenBiol.* **7** : 217) and in 1934 (p. 15) from the Bukowina, stating (on p. 27) that topotypes from Herculesbad are exactly the same, and so are those of the small second generation *pygmaea* Hormuzaki, collected from 26th August to 17th September at Sagarcea, near Dolj, and in southern Oltenia. The specimen which I figure (pl. 12, fig. 301), although from Mehadia, lacks that peculiar plateau entirely.

Hormuzaki gave the name *pygmaea* Hormuzaki to the second generation of race *mehadiensis* Gerhard. His type material was taken in Rumania at Sagarcea, Dolj, between 26th August and 17th September, while other specimens

were taken in southern Oltenia. Hormuzaki described the palpi, the shape of the wings, and their pattern as similar to those of race *mehadiensis* Gerhard; but he stated that *pygmaea* Hormuzaki differed from *mehadiensis* Gerhard by its considerably smaller size and by the fact that the lateral epiphyses of the clasps have, on their dorsal side, a series of four or five erect teeth, whereas in the genitalia of all races of *M. athalia* (Rottemburg) these processes are armed with only one or two teeth, before the apex. The shape of the lower edge of the clasps is of the convex type characteristic of race *mehadiensis* Gerhard.

(xlix) *MELITAEA ATHALIA* Rottemburg race *BORIS* Frühstorfer.

Pl. 9, fig. 233 ♀ (type).

Melitaea athalia boris Frühstorfer, 1917, *Soc. ent.* **32** : 19.

This race was described originally from a female holotype, which I figure, taken in the Rhodope in Bulgaria, and from three paratypes from Slivno; the latter are no longer in the Frühstorfer collection, and I have not seen them. The features to which Frühstorfer drew attention are that its size surpasses that of races *limera* Frühstorfer and *scardona* Frühstorfer, making a handsomer insect of it, and that the extent of the fulvous and the consequent thinning of the black pattern surpass those seen in the most extreme examples of races *scardona* Frühstorfer and *mehadiensis* Gerhard in the same direction of variation. In typical examples of race *boris* Frühstorfer the base of the wings has also very little black suffusion, so that the black markings stand out clearly right down to the root of the wing, such as it never does in the three darker forms just mentioned. This is shown well by the figure published by Gaede (1930, *in* Seitz, *Grossschmett. Erde* **1** (Suppl.) pl. 13, fig. G 4). This race is evidently the variation of races *mehadiensis* Gerhard and *scardona* Frühstorfer in exactly the opposite direction from that of races *limera* Frühstorfer and *diaminoides* Verity. Its size, colour, and general aspect somewhat recall *M. ambigua* Ménétriés. Its geographical range remains to be established.

(l) *MELITAEA ATHALIA* (Rottemburg) race *ATHALIA* (Rottemburg).

Pl. 5, figs. 105, 106 ♂♂, 107 ♀; Genitalia pl. 12, fig. 302 (same specimen as that illustrated on fig. 105).

Papilio athalia Rottemburg, 1775, *Naturforscher* **6** : 5; *Melitaea athalia* (Rottemburg) form *retyezatica* Diószeghy, 1930, *Verh. siebenburg. Ver. Naturk.* **79/80** : 212, pl. 2, figs. 1 ♂, 2 ♀.

I need scarcely recall that this name was proposed by Rottemburg for an insect described but not named by Geoffroy. It was taken in the neighbourhood of Paris, which is therefore the type locality of the nominotypical race here under consideration. The distinctive features of this race, which differentiate it from those dealt with immediately above, are its smaller size and the distinctly thinner black bands on the outer part of the wings on the upperside; on the other hand, the basal area on that surface is broadly covered with a thick suffusion of black scaling, which provides a contrast in markings such as is found in some individuals of the alpine races of this species. The reduction of the bands, often amounting to the entire obliteration of one or the other, is so erratic, and the basal suffusion is so variable in extent, that individual variation is very great. Furthermore, such individual variation is increased by changes of tone in the fulvous from bright to dull and from a rich, reddish one to a pale and more yellowish shade. The high degree of variation which

arises from all these combinations seems to occur everywhere where nominotypical *athalia* (Rottemburg) exists and is not replaced by *helvetica* Rühl or by synexergic races, such as race *vividior* Gouin, not only in France but also all over Germany. No local characteristics are detectable anywhere in this vast territory until one meets with race *lachares* Frühstorfer in the north-east or with the alpine races and other races in the south and south-east. It must also be added that in the latter direction the nominotypical race extends locally far into the range of the Balkan races. Thus Hormuzaki recorded it from the Bukowina, as contrasted to the much commoner race *mehadiensis* Gerhard of that country. Diószeghy found it in the mountains of Retczat in Transylvania and was so struck by that contrast that he named it form *retyezatica* Diószeghy. Hormuzaki has examined Diószeghy's typical series and has pronounced it to be nothing but nominotypical *athalia* (Rottemburg) (Hormuzaki 1934 : 26). Finally I possess a series of specimens collected by Querci on Mt. Olympus in localities different from those in which he took race *mehadiensis* Gerhard on that mountain. I observe a remarkable similarity to French and German examples in some of Querci's examples and an approach to race *limera* Frühstorfer in others.

(li) **MELITAEA ATHALIA** Rottemburg race **PARVANIGRA** race n.

Pl. 5, figs. 108 ♂, 109 ♀.

The only locality in central Europe—so far at least as my collection shows—where there exists a locally constant race distinguishable from race *athalia* (Rottemburg) is Byvank in the Netherlands. This is the race which I here name race *parvanigra* Verity. It is separable from the nominotypical race of the species by its smaller size (average length of male fore-wing 17–18 mm., as compared with 19–21 mm. in race *athalia* (Rottemburg)) and by the great extension of the black markings on the upperside. In extreme examples, this latter feature gives a *diamina*-like appearance, although in most examples the basal suffusion of the fore-wings on this surface tends to obscure the normal black markings to a greater extent than in *Melitaea diamina* (Lang) (=*dictynna* Esper), thus producing a different effect. Finally, race *parvanigra* Verity differs from race *athalia* (Rottemburg) on account of the tendency of the larger central bands to broaden out as compared with the outer ones.

The type specimen of this race is a male in the Verity collection, labelled "Byvank, Holland."

(2) Sub-group in which the male genital armature is characterised by the presence of a comparatively short uncus and in which the terminal process of the valve is unusually globular in general shape.[16]

It is worthy of notice that the uncus is peculiarly short and the terminal process of the valve unusually globular in general shape in precisely the two most extreme western races of exerge *athalia* (Rottemburg), if one ignores for this purpose race *vividior* Gouin from the Gironde, both the general aspect and genitalia of which have no doubt been modified by the introduction of a strain of exerge *helvetica* Rühl (as I have already pointed out). In the races of the sub-group here under consideration, the characteristics exhibited are precisely the opposite. These races are in fact the races of exerge *athalia* (Rottemburg) which stand farthest away from exerge *helvetica* Rühl, not to speak of *Melitaea deione* (Geyer). On the other hand, these races resemble

[16] For sub-group (1), see p. 638.

Melitaea britomartis Assmann to a remarkable degree both in their genitalia and (though to a lesser extent) in the thick and regular black markings both on the upper- and under-surfaces of the wings. It is impossible to say whether or not it is a mere coincidence that these races occur in the region which is at once the extreme western limit of the distribution of *M. athalia* (Rottemburg) and just beyond the extreme western limit of that of *M. britomartis* Assmann. This fact suggests, however, that these races may represent a survival of some more ancient grade in the evolution of *M. athalia* (Rottemburg) which has not diverged from *M. britomartis* Assmann to the same extent as have the other races of exerge *athalia* (Rottemburg) of *M. athalia* (Rottemburg). The existence of a survival of this kind in the Atlantic coastal region would be no matter for surprise and would, indeed, be in accordance with a general rule, the existence of which is proved by the evidence afforded in many other species of butterfly. This hypothesis, however, would imply that *M. deione* (Geyer) and *M. britomartis* Assmann had derived by divergence from an ancestor more similar to *M. athalia* (Rottemburg), which fills the gap between them, together of course with exerge *helvetica* Rühl of the last-named species. Such a thesis would be diametrically opposed to that which postulates the origin of *M. athalia* (Rottemburg) from a species of warmer climates, more similar to *M. ambigua* Ménétriés and *M. deione* (Geyer), which had either a slender uncus or no uncus. The one possibility casts a doubt on the other, but transformation in the frigoripetal direction seems to be a necessary result of the history of the earth. It is better, therefore, to look upon the Atlantic races of *M. athalia* (Rottemburg) as the culminating degree of this process, and therefore as having been produced in a manner parallel to that which produced *M. britomartis* Assmann, but in a branch which has been separated from the latter species ever since the days when they were a tropical species of the genus *Phyciodes* Hübner. The resemblance to exerge *helvetica* Rühl is due to similar transformations, effected, however, at a very much later date. *M. britomartis* Assmann is presumably a product of the colder climate of the Polar continent, which migrated southwards in Asia at the end of the Cretaceous period, whereas the races of *M. athalia* (Rottemburg) in question here (as I have already suggested when speaking of the variations of *M. athalia* (Rottemburg) in general) were only produced when their branches of the parent stock reached the Atlantic either before or after the Glacial periods. In the first case I have shown that they would belong to the Miocene relics, which have survived those periods in the warmer Atlantic regions, which then stretched out much farther than nowadays towards the Gulf Stream. Such relics have been detected in many plants and animals. The following races are at present known which possess the characteristics just described.

(lii) *MELITAEA ATHALIA* Rottemburg race *BRITANNA* Verity.

Pl. 5, figs. 110, 111 *bis* ♂♂, 111 ♀; Genitalia pl. 12, fig. 303 (same specimen as that illustrated on fig. 110).

Melitaea athalia Rottemburg race *britanna* Verity, 1914, *Bull. Soc. ent. ital.* **45** : 210.

This race remained isolated in the south of England, and in consequence did not suffer admixture with the new strains from the east when Europe was repopulated after the Glacial period. This race, the types of which were taken at Tavistock in south Devon, is characterised by the following features. Some individuals are larger than are ever seen in France or Germany; some have elongated wings like race *mehadiensis* Gerhard; the general tone of the colour

is dull; the black markings are all uniformly very thick so that there is less of the contrast between the base and the outer portion of the wing, often seen in nominotypical *athalia* (Rottemburg). The basal suffusion is also more extensive on the whole and individuals without it are scarce. The differences in the genitalia make this race much more distinct and peculiar than was first suspected, as may be seen by comparing the genitalia illustrated on figure 303 on pl. 12 with the figures which I give of the genitalia of other races of exerge *athalia* (Rottemburg), including its nearest neighbour, the nominotypical race of Paris (pl. 12, fig. 302), which one would expect to be the one most closely related to it. The tegumen is longer, the uncus is shorter than in any other race, and the valves much rounder in shape. The harpe is much shorter and thicker, and the terminal process much shorter and very broad.

(liii) **MELITAEA ATHALIA** Rottemburg race **PARVAHISPANICA** race n.

I give this name to the race from Aragon and Castille which was figured and described by Agenjo (1934, *Eos* **9** : 108, pl. 10, fig. 4 (genitalia) and pl. 11, fig. 6) but not given a separate name by that author. The specimens examined by Agenjo were taken at San Ildefonso (Segovia, in Old Castile) and Veruela (Zaragoza, in Aragon). By its very small size and its thick black pattern, this race recalls *M. britomartis* Assmann as it does also very much by its genitalia, which exactly resemble those of race *britanna* Verity here illustrated, except that the uncus as shown in Agenjo's figure looks thicker at the apex and more rod-like, somewhat as in the genitalia of *M. ambigua* Ménétriés race *sayanskalpina* Verity as figured on pl. 10, fig. 262. This extreme south-western branch of exerge *athalia* (Rottemburg) is said to be extremely local and scarce, and it is apparently on the way to extinction, after having perhaps survived even the Glacial periods, as I have suggested above in connection with race *britanna* Verity. The fact that this race now lives only in Spain in a few mountain chains suggests that it must have come westwards with the latter northern race during the Miocene epoch and presumably during the colder period of that epoch, which brought over the mouflon and a great many mountain species of the present day from Asia through Asia Minor to Europe.

5. *MELITAEA COREAE* Verity.

Pl. 5, figs. 112, 115 ♂♂, 113, 114, 116 ♀♀; Genitalia pl. 12, figs. 304, 305 (specimens illustrated on figs. 112 & 115 referred to above respectively).

(? = a race of *Melitaea mayi* Gunder, 1929.)

Melitaea coreae Verity, 1930, *Ent. Rec.* **42** : 82; *Melitaea britomartis* Assmann (?) var. *magna* (Alphéraky MS.) Elwes, 1899, *Trans. ent. Soc. Lond.* **1899** : 335 (*nomen nudum*); *Melitaea britomartis* Assmann (?) var. *koreana* (Staudinger MS.) Elwes, 1899, *Trans. ent. Soc. Lond.* **1899** : 335 *nota* (*nomen nudum*); (? = *Melitaea parthenie* Borkhausen var. *latefascia* Fixsen, 1887, *in* Romanoff, *Mém. Lép.* **3** : 303).

In a paper on the Lepidoptera of Corea, Fixsen (1887, Romanoff, *Mém. Lép.* **3** : 302) described as a variety of the supposed *Melitaea parthenie* (Borkhausen) (*i.e.* of *M. parthenoides* Keferstein) an insect which, according to him, only differed from it by a thicker black pattern on the upperside and by a very broad yellow space across the middle of the underside of the hind-wings, the dividing streak of which was not clear in all the internervular spaces. He added that less striking specimens had been brought back by H. v. Hedemann from the "upper Amur region and can be designated as *latefascia*." This last

sentence evidently shows that he intended to give the name particularly to the Amur insects, and this conclusion is confirmed by the fact noted subsequently by Leech (1892, *Butt. China Japan Corea* (1) : 214) that Corean examples always have the characteristic underside space " white instead of yellow, as in Fixsen's *latefascia*." Leech thought that the Corean butterfly agreed with *orientalis* Ménétriés, but this is certainly quite wrong, I therefore gave it the name *Melitaea coreae* Verity. At the same time I noted that it was this species which Seitz (1909, *Grossschmett. Erde* 1 : pl. 66, fig. I) figured as *latefascia* Fixsen.

As to the original *latefascia* Fixsen from the upper Amur, it is most unfortunate that there is apparently no way of ascertaining what it really was. In the Fixsen collection, preserved in the Hamburgisches Zoologisches Museum, there exists no specimen referable to it, as I have been able to make out through the kindness of Prof. Titschack, who has sent to me for examination the whole collection of the species of the genus *Melitaea* Fabricius belonging to this group. Mr. N. D. Riley has examined the series in the British Museum collection, and has found nothing from the Amur, which can be referred to *latefascia* Fixsen, whereas there are four females from Corea of *M. coreae* Verity from the Leech collection of which he has sent me photographs. The Staudinger collection also furnishes no clue in connection with the Amur, the name *latefascia* Fixsen being applied in that collection to Corean examples bearing a label by that author expressing doubts as to whether they were correctly so identified. To this must be added that no specimen from the Amur which I have seen or heard of is in reality specifically connected with *M. coreae* Verity or agrees with Fixsen's description. The latter was therefore apparently mistaken when he lumped it with v. Hedemann's " less striking specimens from the Upper Amur." These latter were presumably either nominotypical *M. ambigua* Ménétriés or (more probably) *M. athalia* Rottemburg exerge *helvetica* Rühl race *asiae* Verity, which in some individuals (compare pl. 1, fig. 23) in my collection actually exhibit the broad yellow space described by Fixsen. As the latter is the only species which does so both obviously and frequently in the Far East, there is every reason to believe it actually is *latefascia* Fixsen, but, on the other hand, it would not be reasonable to apply this name to this form on purely inductive grounds, my quest for proofs having failed, as stated above, in the way of original specimens. The application of that name must thus unfortunately remain an open question, once it has been restricted, as it should be, exactly to the original description.

Turning attention to the Corean insect, one finds on the contrary that it is a most definite and distinct species, not only on account of its genital armature, but still more so on account of the underside aspect of the wings. In this latter feature, the Corean insect differs from the other Palaearctic species of the genus and strongly recalls some Nearctic ones, such as *M. whitneyi* Behr, by the hard and sharply lined markings of the hind-wings which stand out on broad spaces of a dirty or a yellowish-white in the male and of a pure and brilliant silvery white in the female, whilst the space between the two capillary streaks along the outer margin of all the wings is filled with dark chestnut, as it is in most American species but in the palaearctic region only in some races of *M. britomartis* Assmann (within the *athalia* group) and also in *M. diamina* (Lang) (=*dictynna* Esper).

These resemblances seem due to actual relationships of various degrees; for a species—*M. mayi* Gunder, 1929—has recently been discovered in Canada, which closely resembles *M. coreae* Verity not only in those respects but also in

structure and aspect. So much so indeed that *M. mayi* Gunder may later prove to be a race of the same collective species as *M. coreae* Verity. In that case, the name of the collective species would be *M. mayi* Gunder, of which *coreae* Verity would then be a race, since the name *M. mayi* Gunder was published in 1929, whereas *M. coreae* Verity was not published until 1930. For the moment, however, it would be rather premature to unite these insects as races of a single species; and I therefore treat *M. mayi* Gunder as the immediately following separate species.

In any case, the features which *M. coreae* Verity shares with *M. mayi* Gunder seem to suggest that it is more primitive than the other Palaearctic species of this group, which have acquired particular facies of their own. The male genital armature sustains this view. It can be described as combining an uncus which consists in two long thin points, similar to those of the *athalia* group of eastern Europe, with globular valves remarkably similar to those of *M. britomartis* Assmann and of *M. athalia* Rottemburg race *britanna* Verity, in that they also bear short and thick lateral apophyses and short and very broad terminal ones, with numerous spines all along their edge, including the one of their broad anterior plateau. The penis resembles that of *M. britomartis* Assmann by being short and thick and having much less sheath-funnel keel than *M. athalia* (Rottemburg) and a shorter and more blunt apex.

This combination of *athalia*-like characters in the genitalia corresponds with the other characters exhibited by this insect, and in particular with its *athalia*-like size coupled with the boldness of the underside pattern more similar to that of *M. britomartis* Assmann. I need not describe the pattern in detail as the accompanying figures will show it more effectively, but I must note that the apical part of the palpi is entirely of a deep black colour in both sexes and that the chestnut band of the underside, between the marginal capillary streaks, is darker in the female than in the male to such an extent that in the specimen of the latter sex in the Staudinger collection, which I have before me, it is entirely lacking, that space being of the same yellowish-white as the ground-colour of the wing, in general, as is usual in *M. athalia* (Rottemburg). Another remark to be made is that the markings of the upperside are not very extensive, as compared to those of the allied species, and the submarginal bands of the fore-wing even tend to partial obliteration in some individuals, but nearly all the bands have shaded outlines and the basal half of the hind-wing is suffused more or less broadly with black. In some females (compare pl. 5, fig. 113) this melanism is so considerable that Fixsen did not even recognise the species and (on page 302) he referred an example, which he had before him and which he described at length, to the *M. athalia* (Rottemburg), as distinguished both from the *M. ambigua* Ménétriés from Corea and from *M. coreae* Verity, which he referred to as *M. parthenoides* Keferstein (=*parthenie* Borkhausen, auct. *nec* Borkhausen) and included in *latefascia* Fixsen.

Elwes (1899, *Trans. ent. Soc. Lond.* **1899** : 335) mentioned in a footnote the name of *koreana*, which Staudinger had given, *in litt.*, to specimens from Gensan, in Corea, in his own collection and which according to Elwes are those which in 1882 he himself (1882, *Proc. zool. Soc. Lond.* **1881** : 899) had treated as being probably a variety of *M. athalia* Rottemburg " but which is much more like a large dark *britomartis* and quite unlike the Japanese and Corean form of *athalia* known as *niphona*." Elwes added that he also had specimens taken by Jankowski in Manchuria given to him as var. *magna* by M. Alphéraky, which were most like the specimens from Corea, just mentioned. If one were

to take it that these few words of Elwes could give a status to those two names as published by him, and if those insects are really the same, the name *magna* Elwes would have had precedence over the name *koreana* Elwes in that paper, but that is not possible since the insect to which they apply remains for the present a matter of doubt. Elwes quoted the opinion of Hormuzaki, to whom he had submitted these specimens, that they were referable to the insect described in 1892 as *Melitaea aurelia* Nickerl var. *mongolica* Staudinger, 1892 (*Deuts. ent. Z. "Iris"* **5** : 327) and concluded that all these names were synonyms of *latefascia* Fixsen. I think that they can, and had better, be ignored as *nomina nuda*, for they would otherwise only be a source of terrible confusion. Herr Bang-Haas informs me that the name *koreana* was treated by Staudinger as a synonym of *latefascia* Fixsen, being so indicated for six specimens in his collection, two of which are those which Herr Bang-Haas sent me on loan and which I figure together with the genitalia of the male. They are not referable to *mongolica* Staudinger, being in fact specimens of *M. coreae* Verity.

6. *MELITAEA MAYI* Gunder.

Melitaea mayi Gunder, 1929, *Bull. Brooklyn ent. Soc.* **24** : 327, pl. 31, fig. 6 ♂.

This insect was described from a single male collected by J. F. May of Kelwood, on 28th July, 1929, in a small high valley four miles west of Ptarmigan Valley, Banff, Alberta. Gunder remarked that the underside resembles extremely the specimen figured by Seitz under the name of *latefascia* Fixsen, but he stated that the characteristic broad underside space is yellow and not white. Gunder's own figure of the upperside may agree to a certain extent with that of the specimens of *M. coreae* Verity which I have before me, so that if the genitalia are found to be the same, when they can be examined, *M. mayi* Gunder may possibly be found to be co-specific with it. In that case, the name *mayi* Gunder would become the specific name, and *coreae* Verity would have to be treated as the Asiatic representative of the species. Having regard to the fact, though close resemblances and relationships are often to be observed between Nearctic and Palaearctic insects, it is usually found that specific differences exist, and in view also of the fact that *M. mayi* Gunder is at present known from a single example only, I think it better provisionally to retain *M. coreae* Verity and *M. mayi* Gunder as separate species.

7. *MELITAEA BRITOMARTIS* Assmann.

Melitaea britomartis Assmann, 1847, *Z. Ent. Breslau* 1847 Lep. (1) **1** : 2.

In 1930 I pointed out (*Ent. Rec.* **42** : 74, 84) the existence of this large specific group, the component parts of which had until then been mixed up partly with *M. athalia* (Rottemburg) and partly with *M. parthenie* (Borkhausen) (=*aurelia* Nickerl). On that occasion I stated the reasons for adopting the name *M. britomartis* Assmann to designate this species, on the strength of Suschkin's illustration of its genitalia made from examples from Kharkoff from the southern Urals and from the Tarbagatai, which he no doubt was quite right in referring to Assmann's species, whereas Staudinger and all his predecessors, except Lederer and Zeller, had refused to recognise its specific standing. Hormuzaki, who possessed a considerable number of specimens from Asia, set

to work after reading my paper to examine their genitalia and as a result he made the further discovery (1934, *Bulet. Fac. Stiinti Cernauti* **8** : 44) that no race of *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) exists in Asia at all and that race *centralasiae* Wnukowsky (=*mongolica* Staudinger) which I had left as a race of *M. parthenie* (Borkhausen) must be transferred to the specific unit *M. britomartis* Assmann, because it invariably exhibits a well-developed uncus, a character which is the most substantial and conspicuous feature by which that species is distinguished from *M. parthenie* (Borkhausen) which lacks that structure altogether. This conclusion I can now fully confirm as I had reached the same opinion without knowing that Hormuzaki had done so. In the same paper Hormuzaki fixed another important point which I have already mentioned in regard to *M. athalia* (Rottemburg), namely, that *dictynnoides* Hormuzaki must be referred to the species *M. britomartis* Assmann too, as I had suggested it very probably should, in laying stress on its considerable resemblance to the true *M. plotina* Bremer, a race of the last-named species. Hormuzaki has, in fact, found that the most highly characterised specimens of race *dictynnoides* Hormuzaki have the genitalia of *M. britomartis* Assmann, and he has had to remove from amongst them the melanic examples of *M. athalia* (Rottemburg) which he had confused with them owing to their strong resemblance of external aspect.

M. britomartis Assmann is easily distinguished from both its very close allies, namely, *M. athalia* (Rottemburg) and *M. parthenie* (Borkhausen) (=*aurelia* Nickerl), by the features of the male genitalia :—from the former by the shortness and thickness of all the processes of these organs; and from the latter, which it would otherwise resemble most, by the presence of a well-developed uncus, which that species lacks entirely.

It must, however, be noted that there exists no one single feature absolutely peculiar to *M. britomartis* Assmann, and that some of those which are usually present disappear occasionally in some individuals and in some races. The most characteristic feature is perhaps the globular shape of the valves, which are instead longer and more quadrangular in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) and in *M. athalia* (Rottemburg), with the exception, in the case of the latter, of the remarkable race *britanna* Verity.

On the other hand, the figures which I give of race *septentriorientis* Verity (pl. 13, fig. 311) and of the example of race *seminigra* Seitz (pl. 13, fig. 309) from Turkiensk (Sayansk) show that the valves of *M. britomartis* Assmann do lose their most characteristic shape in some races and individuals.

The next peculiarity of *M. britomartis* Assmann may be taken to be as compared to *M. athalia* (Rottemburg), *M. ambigua* Ménétriés and *M. pacifica* Verity, the shorter and much thicker processes of the uncus, the apexes of which are very often strongly bent towards each other, and are in any case never straight. The harpe is always shorter and thicker than in *M. athalia* (Rottemburg), being about the same as in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) but usually with longer teeth along its edge so that it looks more like a comb. Also the terminal apophysis is similar to the one of *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) in that it is short and extremely broad. One can in *M. britomartis* Assmann distinguish two types of genitalia characterised chiefly by this apophysis. The existence of these two types is particularly interesting because these types are (as far as I have seen) racially constant, with the result that the races of this species fall into two groups.

In the group of races proper to the far east of Asia (Group A), the terminal apophysis is exactly like that of *M. parthenie* (Borkhausen), the shorter forepart

consisting of a very broad plateau with tiny teeth along its terminal edge, and the longer hindpart consisting usually of a fork formed by two long diverging points or occasionally in one long point. The valve as a whole is not globular, but is the same as in the latter species. The tegumen is like that species also, in that it is very short and crescent-shaped. The uncus is larger than in the next group.

The group of races (Group B) which overlaps the preceding in Amurland, with race *amurensis* Staudinger, and extends westwards to Europe, exhibits the peculiar globular valves with a less broad terminal apophysis (in that the plateau is replaced by a much narrower point with two or three teeth only at its end) somewhat as in true *M. athalia* (Rottemburg), but shorter, the tegumen being even longer and more trapezoid than in the latter and the uncus very small.

It will presently be seen which races belong to each of these groups. It only remains to add here that the size and shape of the two points on the fore-edge of the saccus are so variable in the three species which I am comparing that they are of no value in distinguishing them. Hormuzaki's attempts to make such use of the character was, in my opinion, quite unsuccessful.

The end of the penis (or aedeagus) affords an excellent specific feature, well illustrated by Suschkin, who gave the name "Ostiumkiel" (= ostium-quill) to the apical part, which protrudes from the chitinous sheath. In *M. britomartis* Assmann, as in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl), the funnel-shaped end of the latter is much less broad than in *M. athalia* (Rottemburg). The apical part protruding from it is much less thick, bloated and prominent. It is also much shorter than the thin but long process seen in *M. parthenie* (Borkhausen) and in *M. asteria* Freyer, and is scarcely bent upwards at all, whereas in the two latter species it is turned up in a most peculiar manner, like a hog's snout.

As to external characters distinguishing *M. britomartis* Assmann from its closest allies, one can only say that no really reliable one has been detected, for those which are of use in some cases are even less definite and peculiar to the species than are those of the male genital armature described above.

The size and the general facies are the same as those of *M. parthenie* (Borkhausen) (=*aurelia* Nickerl), and that is why *M. britomartis* Assmann was confused with that species until the definite distinction afforded by the uncus was discovered. The features which make it possible to recognise *M. britomartis* Assmann in a certain number of individuals and especially in some races are given below. These characters are useful also in distinguishing this species from the smaller specimens of *M. athalia* (Rottemburg), with which otherwise the latter species might be confused in certain races. This is the error which Hormuzaki made in the case of *M. britomartis* Assmann race *dictynnoides* Hormuzaki and which Reverdin made in that of *M. britomartis* Assmann race *aureliaeformis* Verity from Turin. These are, however, precisely two cases in which some of the characters which I am about to mention prove unreliable, showing how impossible it is to rely upon any single character, the presence of two or three characters in combination alone affording a certain degree of certainty as to the correctness of any given determination.

The hairs of the palpi are never red to the extent they are in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) except in the peculiarly distinct race *septentriorientis* Verity. These hairs are usually entirely black, with some white or yellowish ones on the sides. Occasionally a few hairs are red, but only towards the end of the palpi. The tone of fulvous is in some races (including nominotypical

M. britomartis Assmann) deeper than it usually is in the other species, and furthermore it is as a rule distinctly duller. The black pattern is normally more regular and even over all the wing surface, besides being extensive, so that the fulvous appears like rows of small or very small quadrangular spots standing out more or less sharply on the black. The underside can best be described in a few words by saying it tends to resemble that of *M. diamina* (Lang) (=*dictynna* Esper), owing to the black pattern being of the same thickness all over both fore- and hind-wing, with the result that it stands out very prominently and it looks harder and stiffer than in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) and in most examples also of *M. athalia* (Rottemburg). The russet too is of a deeper tone, tending to chocolate in some races and individuals, just as in *M. diamina* (Lang). The discal spots of that colour may even contain a trace of dark scales equivalent to the sharper black dot which they contain in *M. diamina* (Lang). The resemblance to the latter species is increased by the two following underside characters which can be considered as the most definite characters of *M. britomartis* Assmann when they are present, because none of the closest allies of this species ever produces them even individually. Unfortunately, however, these characters are never produced by any of the most western races of *M. britomartis* Assmann, such as those of Italy. The first and most striking of these features consists in the fact that the space between the two capillary marginal black streaks of the hind-wing is filled with russet or at least with a deep golden yellow darker than the ground-colour, whereas in the other species it is the same as the ground-colour. The second feature, which is less conspicuous in character, is detectable in many of the individuals of the more eastern races of *M. britomartis* Assmann, which most nearly resemble *M. diamina* (Lang). Just inside the dorsal margin of the hind-wings on the underside there is a spot between the two anal nervures and before the tornus (anal angle). In *M. diamina* (Lang) it consists of a comparatively broad lozenge of russet scales edged with black anteriorly and posteriorly. In the *athalia* group, it is either shrunk into a triangle pointing inwards and containing only yellow scales, or reduced still further into a single black streak. In the foregoing individuals of *M. britomartis* Assmann the tip recalls *M. diamina* (Lang) by being filled with russet scales. Although so minute a feature, this character was expressly noted by Assmann in his original description of *M. britomartis* Assmann.

It must finally be added for the purpose of distinguishing *M. britomartis* Assmann from *M. athalia* (Rottemburg) that *M. britomartis* Assmann affords the same feature as that presented by *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) and by *M. parthenoides* Keferstein (=*parthenie* Borkhausen, auct. *nec* Borkhausen), a fact which proves very useful in determining specimens:—on the underside of the fore-wing, the premarginal black arch between the medial and the first cubital nervure does not project inwards more than the other arches, as it does very prominently in all the races of *M. athalia* (Rottemburg) except the special ones from eastern Europe, which I have described as bearing a remarkable resemblance to *M. parthenoides* Keferstein.

In concluding this preliminary survey of the specific unit presented by *M. britomartis* Assmann, it is interesting to note the curious fact that it has taken lepidopterists nearly two centuries after the discovery of *M. athalia* (Rottemburg) and of *M. parthenie* (Borkhausen) and allied species to realise the existence of this species and to work out the extent of its variation, although it is in fact a considerably more widespread species than any of its closest allies. One is now in a position to realise the position, having at last established that *M. parthenie*

(Borkhausen) does not occur in Asia, and that in that continent *M. parthenoides* Keferstein and *M. varia* Herrich-Schäffer are replaced by *M. alatauica* Staudinger, whereas *M. britomartis* Assmann occurs more or less continuously across Asia and the greater part of Europe, from the Pacific coast to Piedmont.

Group A. Group of races proper to the Far East of Asia.[17]

(i) *M. BRITOMARTIS* Assmann race *CENTRALASIAE* Wnukowsky.

Pl. 5, figs. 117–120 ♂♂; Genitalia pl. 12, figs. 306, 307 (same specimens as those illustrated on figs. 117 and 118 referred to above respectively); pl. 13, fig. 308 (same specimen as that illustrated on fig. 119 referred to above).

Melitaea aurelia centralasiae Wnukowsky, 1929, *Zool. Anz.* **83** : 222 (nom. nov. pro *Melitaea aurelia* Nickerl var. *mongolica* Staudinger, 1892); *Melitaea aurelia* Nickerl race *mongolicola* Verity, 1930, *Ent. Rec.* **42** : 83 (nom. nov. pro *Melitaea aurelia* Nickerl var. *mongolica* Staudinger, 1892); *Melitaea aurelia* Nickerl var. *mongolica* Staudinger, 1892, *Deuts. ent. Z.* "*Iris*" **5** : 327 (invalid because a homonym of *Melitaea maturna* Linnaeus var. *mongolica* Staudinger, 1892).

It is desirable to note this race at this point because of the form of its male genital armature which I had not examined in 1930 (at the time that I erected the name *mongolicola* Verity), and I consequently still believed that this insect was the asiatic representative of *M. parthenie* (Borkhausen) (=*aurelia* Nickerl), this being the view both of its original author and of all other entomologists who had dealt with it. Hormuzaki has subsequently discovered that this insect is, on the contrary, referable to *M. britomartis* Assmann, as I have already mentioned. I can fully confirm this conclusion on the evidence of two of the "original" specimens of *mongolica* Staudinger from the Staudinger collection sent to me on loan by Herr Bang-Haas, and which I figure. One of these specimens is labelled "Kentei," which is the locality given by Staudinger for the type of *mongolica* Staudinger. The large series of specimens from the Turkinsk White Mountains, 2000 m., in the Sayansk Mountains, to the south-west of Lake Baikal, which I received some years ago from Bang-Haas, agree exactly with the former in all respects, as well as with the original description. They are characterised by the bolder fulvous spaces which are of a particular deeper tone, which Staudinger calls "much more brown on the upperside," and by the russet markings of the underside "brighter and more saturated" (Staudinger). I should add that the row of spots of that colour across the disc is much larger than is ever the case in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl) with which Staudinger compared *mongolica* Staudinger. A distinctive character is also afforded by those spots on the upperside where they stand out boldly as a premarginal row of fulvous spaces on the otherwise very dark wing. On the underside of the fore-wing the black markings are very complete, dark and sharp to the highest exhibited by *M. britomartis* Assmann. This race to the naked eye is remarkably similar to *M. ambigua* Ménétriés race *sayanskalpina* Verity. In the series in my collection this form is perfectly constant and racial, but I have another series also from the Turkinsk region, presumably obtained by another collector in a different locality, because its labels are worded in a different way. This latter series consists of the following race which is entirely different and is much more similar to those found in the West.

[17] For Group B, see p. 655.

(ii) *M. BRITOMARTIS* Assmann race *SEMINIGRA* Seitz.

Pl. 5, figs. 121 ♂, 122 ♀; Genitalia pl. 13, fig. 309 (same specimen as that illustrated on fig. 121 referred to above).

Melitaea aurelia Nickerl form *seminigra* Seitz, 1909, *Grossschmett. Erde* **1** : 221, pl. 66, fig. H 6 ♂, 7 ♀.

The figures given by Seitz correspond perfectly with examples of this race, though it must be noted that the males are, as a rule, not quite as melanic as the extreme individual form figured by Seitz, being often transitional to race *menetriesi* Caradja. This race, on the whole, is smaller than *centralasiae* Wnukowsky, the markings being softer and the fulvous duller and paler. These two last features also distinguish it from race *imitans* Verity, quite apart from the genitalia. The type of *seminigra* Seitz came from Sajan.

(iii) *M. BRITOMARTIS* Assmann race *MENETRIESI* Caradja.

Pl. 5, fig. 123 ♂; Genitalia pl. 13, fig. 310 (same specimen as that illustrated on fig. 123 referred to above).

Melitaea parthenie Borkhausen var. *menetriesi* Caradja, 1895, *Deuts. ent. Z.* "*Iris*" **8** : 50 *nota* (nom. nov. pro *Melitaea parthenie* Borkhausen var. *orientalis* Ménétriés, 1859); *Melitaea parthenie* Borkhausen var. *orientalis* Ménétriés, 1859, *in* Schrenck, *Reisen Forsch. Amur-Lande* **2** (1) : 23, pl. 2, fig. 5 ♀ (invalid because a homonym of *Melitaea artemis* [Schiffermüller & Denis] var. *orientalis* Herrich-Schaeffer, 1845).

I have already mentioned that I possess a specimen from Pokrowsk, near the confluence of the Shilka and of the Amur in western Amurland, which agrees very well with the example figured by Ménétriés from Bouri, collected by Schrenck on 7th July. I have no hesitation in applying the name *menetriesi* Caradja to it. Its characteristics are the pale, yellowish and dull tone of the fulvous and the thick black pattern, which may be partly effaced on the fore-wing in a way that is never seen in *M. britomartis* Assmann except in some examples of race *frigidaltaica* Verity and of race *septentriorientis* Verity. I shall show, when dealing with race *amurensis* Staudinger from the warmer parts of the Amur basin, that these features distinguish race *menetriesi* Caradja from the last-named race in addition to the male genital armature which belongs to this exclusively eastern type and shows that its proper position is here and that race *seminigra* Seitz is its dark mountain representative.

(iv) *M. BRITOMARTIS* Assmann race *SEPTENTRIORIENTIS* Verity.

Pl. 5, figs. 124–126 ♂♂; Genitalia pl. 13, fig. 311.

Melitaea britomartis Assmann race *septentriorientis* Verity, 1930, *Ent. Rec.* **42** : 74; *Melitaea parthenie* Borkhausen var. *orientalis* Ménétriés, 1859, *in* Schrenck, *Reisen Forsch. Amur-Lande* **2** (1) : 23 (*pro parte*).

In my paper published in 1930, I discussed at length this race from Kamchatka both from the point of view of the name by which it should be known and also from that of its highly distinctive features. As regards the former, I explained that it was the insect which by a misidentification was formerly (wrongly) referred to *orientalis* Ménétriés; and as regards the latter I expressed the view that its features were so distinctive that it might be necessary to regard it as constituting a separate exerge of *M. britomartis* Assmann. This latter suggestion has, however, been shown to have been misconceived by the more extensive information now available regarding the structure of the male

genitalia of *M. britomartis* Assmann, which has shown that the structure exhibited by race *septentriorientis* Verity exists also in other races of this species which have a quite different general facies, namely those which I include in the present group. This race evidently stands to the latter races as their glacial representative, and most of its peculiar features are the result of extreme frigoripetal variation, as proved by their very great resemblance to those of the culminating species *M. asteria* Freyer, in which they have become specifically constant, together with its psychrotropic constitution, which is quite incapable of withstanding any surroundings but glacial ones. The underside patterns are exactly the same and in particular they both have the excessively broad premarginal silvery-white spaces on the fore-wing as well as on the hind-wing, which stretch on the former as far as the tornus. One difference to be observed is that race *septentriorientis* Verity always has the thin, but visible, second capillary line along the antemargin, whereas the fact that it is usually obliterated in *M. asteria* Freyer is considered the most important specific peculiarity of it. This is, however, not correct, because even in Europe individuals exist in which this feature is quite detectable, apart from the asiatic *M. asteria* Freyer race *rebeli* Wnukowsky in which it is always present. A notable character of race *septentriorientis* Verity is constituted by the palpi, which in most individuals are covered with bright red hairs, both above and below, to an extent only found in some extreme examples of *M. parthenie* (Borkhausen) (=*aurelia* Nickerl). Moreover, the size and the general aspect of the insect are quite similar to *M. asteria* Freyer, and the light and pale tone of the fulvous of the upperside, the irregular extent of the various parts of the pattern being particularly different from the characteristic colouring and markings of *M. britomartis* Assmann, but more often seen in *M. parthenie* (Borkhausen) (=*aurelia* Nickerl). The premarginal black pattern is thinner than usual in this species, whereas the central band is very thick and the basal suffusion is very dark and tends to extend over all the medial half of the wings. The shape of the wings is also more triangular than the most characteristic form of *M. britomartis* Assmann, since the apical angle is somewhat more elongated.

Group B. Group of races which extend across Asia westwards towards Europe.[18]

In Group A, I have placed together the series of races which begins with those races which (viewed by the naked eye) are the most *athalia*-like in general facies and which ends with those races which, on the contrary, more closely resemble *M. parthenie* (Borkhausen) (=*aurelia* Nickerl). The last race in Group A was, as will be seen above, race *septentriorientis* Verity, a race produced by the glacial periods. It is consequently one of the most recent forms of this group of the genus *Melitaea* Fabricius, according to the latest views on this subject, which agree well with the conclusions established as the result of the study of the genitalia of the species of this genus and of those of their presumed ancestral species of the genus *Phyciodes* Hübner. The inferences which I drew on this subject in my paper in 1930, where I treated race *septentriorientis* Verity as constituting the root of the *britomartis* branch, must now be revised in accordance with the standpoint now adopted, namely that *M. asteria* Freyer, *M. parthenie* (Borkhausen) (=*aurelia* Nickerl), and the species of the genus which have no uncus to the tegumen are not, as I previously thought, the primary specific units from which those species which have an uncus have

[18] For Group A, see p. 653.

been derived. These species represent a branch or branches, parallel to the latter, which have been separated from it, this separation dating presumably from the days of the ancestral tropical species of the genus *Phyciodes* Hübner. It may be supposed that one of these branches was particularly suited to face glacial conditions, as these set in, and that this branch was transformed by frigoripetal variation into the highly psychrotropic constitution possessed by *M. asteria* Freyer. It may further be supposed that another similar branch became *M. varia* Herrich-Schäffer, parallel in the same way to its close ally *M. parthenoides* Keferstein, which has an uncus like *M. britomartis* Assmann.

This view of parallelism since extremely ancient times rather than the theory of direct descent from each other of most of the species and exerges living to-day agrees much better with the remarkable resemblance between the genitalia of *M. britomartis* Assmann and those of the most western races of true *M. athalia* (Rottemburg), namely *britanna* Verity and *parvahispanica* Verity. When dealing above with the two last-named races, I suggested that these characteristics may have been acquired at a later period than happened in the case of *M. britomartis* Assmann (namely in the Miocene period or still later) by a stock which had reached the Atlantic during that period. If this were the case, it would provide another case of the repetition of transformations on a lesser scale, according to a very general law which I have recalled. The repetition in the case of *M. athalia* (Rottemburg) would have been a repetition at the racial organic level of variation of the one which had, much more anciently (*i.e.* during the Cretaceous epoch), led to the separation of *M. britomartis* Assmann from the stock which subsequently gave rise to the species and exerges which I have already described in dealing with the origins of *M. athalia* (Rottemburg).

(v) **M. BRITOMARTIS** Assmann race **FRIGIDALTAICA** race n.

Pl. 5, figs. 127–129 ♂♂; Genitalia pl. 13, fig. 312 (same specimen as that illustrated on fig. 127 referred to above).

Some years ago Herr Bang-Haas sent me a long series of specimens each of which bore a minute printed label of the kind used by Staudinger, inscribed with the words " Altai centr. mont.". I at first took these insects to be the same as that which Elwes in his paper on the butterflies of the Altai Mountains (1899, *Trans. ent. Soc. Lond.* **1899** : 335) said he found in the high Tchuja Mountains at an altitude of 7000–8000 feet. This was the insect which Elwes referred to *M. aurelia* Nickerl (*i.e.* to the insect the true name of which is *M. parthenie* (Borkhausen)), of which he considered it to be a " small paler form," nearest perhaps to *orientalis* Ménétriés brought by Herz from Kamchatka. Staudinger, however, recognised that the insect taken by Elwes was referable to *M. asteria* Freyer. I explain later (p. 676) how the examination of the genitalia of this insect completely confirms Staudinger's conclusions. The specimens received from Herr Bang-Haas (referred to above) have proved to be not this eastern race of *M. asteria* Freyer but perfectly characterised specimens of *M. britomartis* Assmann, so far as their male genital armature is concerned. They differ in this respect, therefore, from the Kamchatka race (*septentri-orientis* Verity) of this species, in which the genital armature is of the type peculiar to the Far East (Group A above). They differ also from race *orientalis* Ménétriés from the basin of the River Amur, which has the same type of genitalia.

To the naked eye these races resemble each other by the fulvous being paler and less reddish in tinge than is usual in *M. britomartis* Assmann and by the thinner and more variable black pattern. Race *frigidaltaica* Verity differs from race *orientalis* Ménétriés also by the considerably greater extent of the black suffusion at the base of all the wings, which recalls the aspect of race *septentriorientis* Verity in many individuals, without, however, quite reaching the same extent. The central S-shaped band does not have the characteristic thickness which it has in the latter. On the underside, race *frigidaltaica* Verity is similar to races *orientalis* Ménétriés and *amurensis* Staudinger. All these races differ very much on the underside from race *septentriorientis* Verity, having none of its large lunules and white spaces on either fore- or hind-wing and none of their very pure white and silvery appearance. It must also be added that many individuals of race *frigidaltaica* Verity are transitional to race *plotina* Bremer of the warmer Altai valleys, as recorded by Elwes. A few extreme examples even have the *diamina*-like underside of the latter race quite fully developed, whilst a few other individuals point to race *centralasiae* Wnukowsky by their bolder pattern and warmer fulvous on the upperside. Race *frigidaltaica* Verity is therefore considerably more variable than race *septentriorientis* Verity, and looks on the whole decidedly distinct from it, quite apart from the genitalia. In size it is larger not only than the latter but even more so than *centralasiae* Wnukowsky and the other oriental races, and the wings are broader in many individuals.

The type of race *frigidaltaica* Verity is a male in the Verity collection, and (as already explained) bears, in common with the whole of the typical material, a label bearing the words " Altai centr. mont.".

(vi) *M. BRITOMARTIS* Assmann race *AMURENSIS* Staudinger.

Pl. 5, figs. 130 ♂, 131, 131 *bis* ♀♀; Genitalia pl. 13, fig. 313 (same specimen as that illustrated on fig. 130 referred to above).

Melitaea aurelia Nickerl var. *amurensis* Staudinger, 1892, *in* Romanoff, *Mém. Lép.* **6** : 186.

Herr Bang-Haas very obligingly sent me on loan a pair of the specimens from Raddejewska labelled " Origin " by Staudinger. I am therefore enabled to figure cotypes of this race and also to figure the genitalia of the male. It will be seen that the genitalia are quite typical of *M. britomartis* Assmann. I am thus able definitely to settle the systematic position of this race which Staudinger, its original author (as shown above), attributed to *M. aurelia* Nickerl (*i.e.* to *M. parthenie* (Borkhausen)), and which Hormuzaki (1934, *Bul. Fac. Stii. Cernauti* **8** : 28) actually referred to *M. athalia* (Rottemburg) on the strength of a specimen sent to him by Staudinger, the genitalia of which he illustrated. In his original description Staudinger mentioned first the locality Raddejewska, to which he added that he had received specimens also from the much more southern regions of Ussuria and Sutschan. As regards the characteristics of this race, Staudinger said merely that it differed from European examples of *M. aurelia* Nickerl (*i.e.* of *M. parthenie* (Borkhausen)) very distinctly by reason of the " strongly brown transverse bands of the underside of the hind-wing." I now, of course, know that this difference is nothing but one of the characteristic *britomartis* features of this insect. In 1901 (*Cat. Lep. pal. Faunengeb.* : 32) Staudinger expressed the opinion that race *amurensis* Staudinger could hardly be considered distinct from race *mongolica* Staudinger (*i.e.* from *centralasiae* Wnukowsky) except on the strength of its locality. This

opinion also has turned out to be erroneous, since the genitalia of the two races are not the same. In any case, to the analytical eye of the present day, the general facies of these insects suggests two very distinct races. Apart from transitional individuals, *centralasiae* Wnukowsky is characterised by the black pattern on both surfaces being much heavier than in *amurensis* Staudinger, the premarginal russet spots of the underside being much larger also. It is worth observing that, to the naked eye, race *amurensis* Staudinger does not differ very much from *orientalis* Ménétriés (*i.e.* from *menetriesi* Caradja). It is, however, not possible to use the name *amurensis* Staudinger in place of *menetriesi* Caradja as a substitute for the invalid homonym *orientalis* Ménétriés, since the differences between the genitalia of the two races render their union impossible. Even if these races had not been distinguished by possessing different genitalia, it would, however, have been not disadvantageous to draw a distinction between the pale and thinly marked form figured by Ménétriés (*i.e. menetriesi* Caradja) and the much more richly coloured and bright reddish form (race *amurensis* Staudinger) which occurs not only in the basin of the River Amur (as stated by Staudinger) but also in Ussuria (as is shown from examples in my collection). For these reasons I retain the name *amurensis* Staudinger for the race occurring in these regions.

The figure given by Seitz (1909, *Grossschmett. Erde* **1**: pl. 66, fig. H) for *amurensis* Staudinger is entirely misleading, since it clearly represents a female example of nominotypical *M. ambigua* Ménétriés.

(vii) *M. BRITOMARTIS* Assmann race *PLOTINA* Bremer.

Pl. 6, figs. 132, 133 ♂♂, 134 ♀; Genitalia pl. 13, fig. 314 (same specimen as that illustrated on fig. 132 referred to above).

Melitaea plotina Bremer, 1861, *Bull. Acad. Sci. St. Petersb.* **3**: 465; *ibid.*, 1864, *Lep. Ost-Sibir.*: 14, pl. 3, fig. 2.

Both in a paper which I published in 1930 (*Ent. Rec.* **42**: 109) and again more fully in the present paper (p. 594 above), I have drawn attention to the mistake made by Staudinger and other authors in applying the name *M. plotina* Bremer to the insect to which I have since given the name *M. pacifica* Verity. Bremer's excellent figure clearly represents an entirely different insect, which was captured in the Bureja Mountains, and is, in fact, the most highly characterised race of *M. britomartis* Assmann.

The chief features of race *plotina* Bremer are the remarkably elongated shape of the wings, the deep reddish and very dull tone of the fulvous on both surfaces (the russet colour of the underside often being brownish and blackish as in *M. diamina* (Lang) (= *dictynna* Esper), though not in Bremer's figure) and the extremely thick black markings of the underside, which reduce the white spaces to small white dots in the most extreme examples, *e.g.* in Bremer's type. The figure which I give of the genitalia shows that these organs also are highly characteristic of *M. britomartis* Assmann. The black markings of the upperside of the wings are not as extensive as in the most extreme examples of race *seminigra* Seitz but they constitute broad and very regular and nearly parallel bands, a feature which is also very characteristic of *M. britomartis* Assmann.

This race is apparently quite constant in some localities, except for a certain percentage of individuals transitional to, or identical with, race *imitans* Verity, for this is the preceding degree of the same line of variation, as is shown by the

series of specimens I possess from Chulugaisha 2600 m. in the Mondy region of the eastern Sayansk Mountains. I possess also a highly characterised example of race *plotina* Bremer from Arasan (2000 m.) in the Altai (from the Elwes collection) which evidently belongs to this race which is usually found at lower altitudes. Elwes recognised this as belonging to *M. britomartis* Assmann, and he contrasted it with the race of *M. asteria* Freyer which, as explained above, he had misidentified as *M. aurelia* Nickerl (*i.e. M. parthenie* (Borkhausen)).

(viii) *M. BRITOMARTIS* Assmann race *IMITANS* Verity.

Pl. 6, figs. 135 ♂, 136 ♀.

Melitaea britomartis Assmann race *imitans* Verity, 1930, *Ent. Rec.* **42** : 83.

I named this race on the strength of the specimen figured (quite wrongly) by Reverdin (1922, *Bull. Soc. lép. Genève* **5** : pl. 1, fig. 4) under the name *M. athalia* (Rottemburg) var. *kenteana* Seitz. This specimen was taken at Tchita in the Transbaikalia province between the Kentei Mountains and the Amur. When naming this race, I pointed out that Seitz was the first author to give a status to the name "*kenteana*," which he did by providing both a description and a figure. Seitz's figure represents an example of a race of *M. ambigua* Ménétriés. The name *kenteana* Seitz is therefore entirely inapplicable to the insect figured by Reverdin, which is very close to *M. britomartis* Assmann race *britomartis* Assmann, as is seen also from the highly characteristic genital armature figured by Reverdin (*loc. cit.* **5**, pl. 2, fig. 5). In this respect race *imitans* Verity belongs decidedly to the present group of races (Group B). It corresponds with race *seminigra* Seitz of the other group (Group A), but it differs from that race not only in the genitalia but also through being less extremely melanic. In general, race *imitans* Verity may be described as intermediate between race *plotina* Bremer on the one hand and race *seminigra* Seitz of the west and race *amurensis* Staudinger of the east on the other.

(ix) *M. BRITOMARTIS* Assmann race *MARUSSIA* Frühstorfer.

Pl. 9, fig. 239 ♂ (type) ; Genitalia pl. 13, fig. 315 (same specimen as that illustrated on fig. 239 referred to above).

Melitaea aurelia marussia Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 171.

This race, which was described from specimens taken at Saratoff on the Volga, was (as shown above) regarded by Frühstorfer as a subspecies of *M. aurelia* Nickerl (*i.e.* of *M. parthenie* (? Borkhausen)). Frühstorfer considered that it was extremely well-figured from a Volga example by Esper (1784, *Die Schmett.* **1** (2) *Forts. Tagschmett.* : 173 (*pro parte*) pl. 89, fig. 2 ♂). Later, I pointed out (1931, *Ent. Rec.* **43** : 102) that, notwithstanding the date, Esper's figure was quite good and that without question it represented an example of *M. britomartis* Assmann belonging to one of the races of that species which resembles *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) considerably. Having now examined Frühstorfer's types, I can confirm these judgments, for I have found that these specimens agree with Esper's figure and also that (as their genitalia show) they are referable to *M. britomartis* Assmann. I figure (pl. 9, fig. 239) the specimen labelled "type" and also its genital armature (pl. 13, fig. 315). It will thus be seen that the latter belongs to the type exhibited by the western groups which I am here dealing with. The race is very melanistic, on the upperside, like race *plotina* Bremer, which it resembles also by the narrow

and elongated wings; it differs from it, however, by the underside not having the peculiar *diamina*-like facies. Esper's figure shows, on the contrary, large, premarginal russet spots on the hind-wing, similar to those of the other oriental races just described, thus distinguishing race *marussia* Frühstorfer also from the European races in general.

(x) *MELITAEA BRITOMARTIS* Assmann race *BRITOMARTIS* Assmann.

Assmann based his description of this insect upon examples taken at Klarenkranst, three miles east of Breslau, near the eastern border of Germany. This, the nominotypical, race is to-day determined not only by Assmann's very minute original description, but also by the restrictions which have been made by recent authors when distinguishing and naming very closely allied races. Assmann laid particular stress on the features which this insect has in common with *M. dictynna* (Esper) (*i.e. M. diamina* (Lang)), especially on the underside, namely, the russet colour between the two capillary marginal streaks and inside the triangular spot near the abdominal margin of the hind-wings, as well as in the dark colour of the russet markings and the black scales inside the submarginal spots of that colour. The nominotypical race is, therefore, the one which resembles *M. diamina* (Lang) on the underside, to a greater or lesser extent, a feature which is quite racial and constant in all the European races except the extreme western (Italian) races and the extreme eastern race, *marussia* Frühstorfer. This definition might have included both the race which has comparatively thin black pattern and broad fulvous spaces on the upperside and also the race which is much more melanic on this surface, but Hormuzaki restricted the nominotypical race *britomartis* Assmann to the former by erecting the name *dictynnoides* Hormuzaki for the latter.

Thus restricted, the nominotypical race inhabits, according to Hormuzaki, the south of Germany, occurring, for example, at Regensburg and at Ischl to the east of Salzburg; in Carniola (Pokojisce); at Bularda, in Bessarabia; and at Tecuci, in southern Moldavia. Hormuzaki states explicitly that he has never found this race in Bukowina.

(xi) *MELITAEA BRITOMARTIS* Assmann race *DICTYNNOIDES* Hormuzaki.

Melitaea aurelia Nickerl var. *dictynnoides* Hormuzaki, 1898, *Deuts. ent. Z.* "*Iris*" **11** : 2; *Melitaea athalia* Rottemburg ab. *fallax* Hormuzaki, 1925, *N. Beitr. syst. InsektenK.* **3** : 70; *Melitaea athalia* Rottemburg var. (an sp. Darw.) *aceras* Hormuzaki, 1911, *Z. wiss. InsektenBiol.* **7** : 214.

This race was described by Hormuzaki from examples taken at Czernowitz in the Bukowina. It is characterised by the aspect of the upperside, which somewhat recalls that of *M. diamina* (Lang) (= *dictynna* Esper) in being so extremely melanic that the hind-wings on the upperside are entirely black, except for one premarginal row of fulvous spots, often very small in size. This slight distinction is thus all that is afforded by this insect after all the attention which it has received in the literature of this species. I have mentioned the comparison which masked the origin of this name and have given the solution of the history in my general remarks on *M. athalia* (Rottemburg) (p. 607). It is therefore unnecessary to refer further to the matter here, beyond mentioning that it was Hormuzaki himself who finally recognised as belonging to *M. britomartis* Assmann the original specimens which he and Staudinger had, at the outset, taken for varieties of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl)

and had suspected were hybrids between the latter species and *M. athalia* (Rottemburg). Hormuzaki cleared up all the earlier mistakes and clarified the correct position of this insect in his paper published in 1934 (*Bul. Fac. Stii. Cernauti* **8** : 34, 62). Hormuzaki also stated in that paper that Seitz' figures of race *seminigra* Seitz are nothing but a perfect illustration of an example of race *dictynnoides* Hormuzaki. According to him, therefore, the former is purely a synonym of the latter. This particular conclusion I cannot accept, because, though some individuals of the two races may look exactly alike, *seminigra* Seitz is on the whole closely connected to the other Asiatic races and often betrays transitional features on the underside, which are never seen in Europe. Moreover, the genitalia of *seminigra* Seitz and *dictynnoides* Hormuzaki usually, if not constantly, differ from one another to such an extent that they fall respectively into the two opposite genitalia groups of this species.

Hormuzaki has established that race *dictynnoides* Hormuzaki is racially constant in the Bukowina, but that it has, on the contrary, been found mixed with less melanic individuals referable to nominotypical *britomartis* Assmann at Ischl and Tecuci, as I have mentioned in my account of the last-named race.

I should add that Hormuzaki suggested (p. 41) that the name *imitans* Verity, given by me to a widespread race in eastern Asia, was a synonym of *fallax* Hormuzaki, a name based on a single specimen taken at Ischl, in Austria, and considered to be an individual aberration by Hormuzaki himself. It need scarcely be said that even though this specimen may very well resemble Reverdin's figure, which I have taken as typical of race *imitans* Verity, as Hormuzaki has noted, it does not follow at all that the races to which these specimens belong are the same; nor is it at all likely they are, in such distant and different surroundings.

As to *aceras* Hormuzaki, which was suspected to be a separate species even by Reverdin (1922, *Bull. Soc. lép. Genève* **5** : 27), when *M. britomartis* Assmann was not known to be a widespread species, it has at last been exactly diagnosed by Hormuzaki (1934, *loc. cit.* **8** : 45, 47). It is a case of ill development of *M. britomartis* Assmann, which in the original specimens from the Bukowina affected both the colour and the genitalia : the former was extremely faded on both surfaces (pale ochre yellow, instead of fulvous; brown, instead of black); the latter were very unusual in structure, and in particular lacked more or less entirely the terminal apophysis of the valves. These features have, since, been observed separately from each other in several regions, and Hormuzaki has proposed that the colour distinctions should be taken as the characteristics of *aceras* Hormuzaki, because the genitalia distinctions occur, according to him, quite as frequently in perfectly normal-looking examples of *M. britomartis* Assmann.

(xii) *MELITAEA BRITOMARTIS* Assmann race *AURELIAEFORMIS* Verity.

Pl. 6, figs. 137, 139 ♂♂, 138 ♀; Genitalia pl. 13, fig. 316 (same specimen as that illustrated on fig. 137).

Melitaea aureliaeformis Verity, 1917, *Bull. Soc. ent. ital.* **48** : 186 (*nota*); *Melitaea melathalia* Rocci form (razza) *taurinorum* Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 210; *id.*, 1932, *ibid.* **11** : 32; *id.*, 1933, *ibid.* **11** : 141 fig. 11B.

This race was described by myself (as *aureliaeformis* Verity) and later by Rocci (as *taurinorum* Rocci) from Venaria in the neighbourhood of Turin, which remains so far its only known locality. The reason that Rocci redescribed

the insect which I had named *aureliaeformis* Verity was that he misidentified the latter with a race of *M. parthenie* Borkhausen (= *aurelia* Nickerl), which flies in the same locality and with which I deal later in the present paper. The present race is on the wing from the middle of May until the end of June, but it seems now to be disappearing from its only known locality.

It will be seen from the figures given that the genitalia of *aureliaeformis* Verity are quite like those of a number of other races of *M. britomartis* Assmann, *e.g.* races *frigidaltaica* Verity, *amurensis* Staudinger, *imitans* Verity, and *plotina* Bremer, all of which in this respect belong to the same group of races. Race *imitans* Verity resembles race *aureliaeformis* Verity very much also in general facies, to the naked eye, as may be judged by reference to the excellent figures given by Reverdin (1922, *Bull. Soc. lép. Genève* **5** : pl. 1, figs. 4, 9; pl. 2, figs. 5, 6). These four figures establish in the clearest possible manner the specific identity of these extreme western and eastern races. Their genitalia also agree exactly with those figured by Suschkin (as *M. britomartis* Assmann) from examples taken at Kharkoff in Russia. I had thought that I had made all this clear in my paper published in 1930 (*Ent. Rec.* **42** : 83, 84, 132), and I find it difficult to understand how Rocci failed to appreciate my explanation. Similarly, I find it difficult to understand Hormuzaki's remark (1934, *loc. cit.* : 29) that he is not acquainted with *aureliaeformis* Verity, but that judging from Reverdin's figures of the insect and its genitalia, it seemed to him so different from *M. britomartis* Assmann that he must leave to me the responsibility of having united them in the same specific group. What made him so doubtful about the specific identity of *aureliaeformis* Verity was the shape of the two projections on the fore-edge of the saccus and the wing pattern, which he considered were much more like *M. athalia* (Rottemburg) than any race of *M. britomartis* Assmann. I have already remarked, in describing the latter's characteristics, that the saccus affords no reliable guide at all, as it varies broadly in both species.

The pattern of race *aureliaeformis* Verity is in reality very distinct and characteristic, if one takes the race as a whole; for it never exhibits, even individually, the underside facies of nominotypical *M. britomartis* Assmann which recalls that of *M. diamina* (Lang) (= *dictynna* Esper) by the features which I have already mentioned. Thus, it never has russet scales either between the two capillary marginal streaks or inside the triangular spot near the inner margin on the hind-wings. In most individuals the light tone of the russet markings and the thinness of the black ones are *M. parthenie* (Borkhausen) (= *aurelia* Nickerl). The upperside also usually recalls the last-named species much more than it does nominotypical *M. britomartis*, by the lighter and less red tone of fulvous and by the thinner black pattern, which is much more irregular and variable. Reverdin was struck particularly by the peculiar, dull, tone of the colours which is now known to be a characteristic of *M. britomartis*, but it is not constant, so that one cannot rely on it, either, in separating this species from *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), with which it flies in the Venaria Park of Turin. Actually the genitalia afford the only safe distinctive features. I have shown that in that structure the most striking feature is the presence of an uncus on the tegumen, in the first-named species, and its absence in the second, but I have also mentioned that in this and the following race the various *britomartis* characters are carried to their highest degree. The valves are globular; the harpe is short and thick; the terminal apophysis is the same, but differs from that of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) in having the plateau replaced by a large point, somewhat

as in *M. athalia* (Rottemburg). The tegumen is very long and trapezoid, the uncus very short and thick.

(xiii) *MELITAEA BRITOMARTIS* Assmann race *MELATHALIA* Rocci.

Pl. 6, figs. 140, 141 ♂♂, 142 ♀; (Gen. II. form *postmelathalia* Rocci) figs. 143, 144 ♂♂, 145, 146 ♀♀; Genitalia pl. 13, fig. 317.

Melitaea melathalia Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184, 185; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 14, pl. 2, figs. 1, 2, 4 ♂♂, 3 ♀; *id.*, 1932, *ibid.* **10** : 203, figs. 2, 3 (genit.), 209; *id.*, 1933, *ibid.* **11** : 140, 150, 151, figs. 2B, 7C, C/, 10A, B, 11A, B (genit.); *Melitaea melathalia* Rocci form. vern. *aureliaesimilis* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 18, pl. 2, figs. 8, 10 ♂♂, 9 ♀; *Melitaea melathalia* Rocci form. vern. *dictynnaesimilis* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 19, pl. 2, figs. 5, 7 ♂♂ 6 ♀; *Melitaea melathalia* Rocci form. aest. *postmelathalia* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 20, pl. 2, figs. 11, 13 ♂♂, 12, 14 ♀♀; *Melitaea melathalia* Rocci form. aest. *parvaurelia* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 21, pl. 2, figs. 18 ♂, 19 ♀; *Melitaea melathalia* Rocci form. (aest.) *aurelitoides* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184; *id.*, 1931, *Mem. Soc. ent. ital.* **10** : 21, pl. 2, figs. 15, 17 ♂♂, 16 ♀.

This insect is not a distinct species, as Rocci supposed through not having grasped the characters of races *aureliaeformis* Verity and *britomartis* Assmann of *M. britomartis* Assmann. The name is, however, available to designate the distinctly different race to which it was originally given. There is a large series of the typical material now in my possession, from Turbigo, in Lombardy, between Milan and Lake Maggiore, where it was collected on the banks of the Ticino, in swampy meadows. It probably is the race of the greater part of the Po basin, in surroundings of this sort.

What, however, distinguishes race *melathalia* Rocci, chiefly, from race *aureliaeformis* Verity is its greater melanism, to which may be added a larger average size and a pattern recalling that of *M. athalia* (Rottemburg) in a most striking manner. Individual variation is very great. Very few specimens, however, exhibit the regular pattern of nominotypical *M. britomartis* Assmann on the upperside. An important peculiarity of this race, which is never seen in race *aureliaeformis* Verity, or in any of the other races of *M. britomartis* Assmann, is that it produces regularly an abundant second generation of small size in July and August. Rocci has named this generation *postmelathalia* Rocci. I figure the genitalia of race *melathalia* Rocci (pl. 13, fig. 317) next to those of race *aureliaeformis* Verity (pl. 13, fig. 316) to show how exactly alike they are to one another.

8. *MELITAEA PARTHENIE* (Borkhausen)

(commonly but erroneously known as *M. aurelia* Nickerl).

Papilio parthenie Borkhausen, 1788, *Naturg. eur. Schmett.* **1** : 53, nom. nov. pro *Papilio athalia minor* Esper [1784]; *Papilio athalia minor* Esper [1784], *Die Schmett.* **1** (Bd. 2) *Forts. Tagschmett.* : 173 (*pro parte*) pl. 89, fig. 1 ♂ (*nec* fig. 2); *Melitaea aurelia* Nickerl var. *serotina* (Guenée MS.) Oberthür, 1909, *Et. Lép. comp.* **3** : 248–249; *Melitaea aurelia* Nickerl race *lucasi* Verity, 1920, *Bull. Soc. ent. Fr.* **1920** : 272–274.

In 1931 (*Ent. Rec.* **43** : 101, 186) I gave a full account of the origin of the name *parthenie* Borkhausen and of the complicated history of the way it and the name *aurelia* Nickerl have been applied in the past by the various leading authors. I have shown that it is perfectly clear that Borkhausen described, and gave the name *parthenie* Borkhausen to, " the butterfly which Herr Esper

had figured under the name of *Papilio athalia minor* on the 89th plate 1st and 2nd figure," to quote his own explicit words. That figure 1 is the species which has for so long been known under the name of *aurelia* Nickerl. The latter name is therefore specifically nothing but a synonym of *parthenie* (Borkhausen). It was chiefly Staudinger's action in 1871, which was responsible for the name having come into general use instead of the much older name *parthenie* Borkhausen, which was applied to a different species, notwithstanding the warning given by Keferstein in 1851 against this error and the fact that he published the name *M. parthenoides* Keferstein for the latter. Kirby alone took the right view (1871, *Syn. Cat. diurn. Lep.* : 169) and corrected the mistakes of the previous authors in his bibliographical references, but unfortunately this action of his was entirely neglected. The result is that one is compelled to make the change now, after a large amount of literature dealing with these species has accumulated under the wrong names.

There is not much to be added regarding the distinctive features of *M. parthenie* (Borkhausen) to what has been said in dealing with *M. britomartis* Assmann, which resembles it to such an extent that the two species remained mixed up together as a single species, until quite recently, when Suschkin (1913) discovered the differences in their genitalia, and I pointed out (1930, *Ent. Rec.* **42** : 74, 84) the large number of races which should be separated from *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) and united as races of the collective species *M. britomartis* Assmann. Hormuzaki carried this investigation a stage further when he ascertained (1934) that the former species does not occur in Asia at all and is a purely western species, peculiar to Europe. Its eastern limit is, as far as I know for the present, the southern Ural Mountains, where Suschkin found it, in company with a race of *M. britomartis* Assmann, and diagnosed both species on the strength of their genitalia. Even in Europe the insect found in Scandinavia and the Baltic regions which used to be thought to be a race of *M. aurelia* Nickerl (*i.e.* a race of *M. parthenie* (Borkhausen)) has, as I have shown, turned out to be a race of *M. athalia* (Rottemburg). The only absolutely constant and reliable character by which to distinguish *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) from *M. britomartis* Assmann is the lack of a well-developed uncus to the tegumen. The other characters afforded by the genitalia are : the constantly narrow and crescent-shaped tegumen; the shape of the valves pointing to that of *M. athalia* (Rottemburg) in being slightly more elongated and quadrangular; the shape of the terminal apophysis, which always has a broad plateau in its fore-part and the longer hind-part ending in two diverging points as in *M. asteria* Freyer. I have shown, however, that all these secondary features are to be found occasionally also in some examples of *M. britomartis* Assmann. A constant peculiarity is afforded by the end of the aedeagus, but, in practice, it cannot always be made use of because it needs a good side view, which cannot always be obtained in the microscopic mount, since the organ is apt to turn in the balsam; the end is distinctly longer and thinner than in any other species and turned up markedly at the tip, like a hog's snout.

The distinctive features visible to the naked eye are only useful in certain races and individuals, for they often fail one in others. The most reliable of these features is the fox-red colour of the hair of the palpi, viewed both from above and from below, but it often is not complete enough to afford full confidence, and in some races such as *imitatrix* Verity from Piedmont it is entirely lacking. On the other hand, there exist also some oriental examples of *M. britomartis* Assmann belonging to *septentriorientis* Verity which have very red palpi

too. The next most generalised difference between these two species is the tone of the wing colour, which is usually bright in *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), and usually decidedly dull in *M. britomartis* Assmann. The upperside pattern rarely is as regular and even over the whole wing surface as it usually is in the latter; it is, on the contrary, very often not only as irregular as in *M. athalia* (Rottemburg) but still more variable, on account of frequent blending of the bands, in an irregular way into black patches, except in the less melanic races, such as are the more western ones occurring in the western Alps and northern France and Germany, in which the pattern is, on the contrary, noteworthy by its thinness in many individuals. As to the underside, the species differs from *M. britomartis* Assmann by never exhibiting the characters described as recalling very much that of *M. diamina* (Lang) (= *dictynna* Esper); and it differs from *M. athalia* (Rottemburg) by not having the strongly projecting premarginal arch between the third median and the first cubital nervure of the fore-wing, which I have mentioned is not present in *M. britomartis* Assmann either. In *M. athalia* (Rottemburg), on the other hand, this longer arch is extremely constant and is only absent (as I have shown) in three or four races and forms of western Europe.

With regard to the position and philogeny of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) in the *athalia* group of the genus *Melitaea* Fabricius, I have already observed at the beginning of this paper that it is quite useless to seek to prove that one species is older than another and directly ancestral in its connection. I have mentioned how the examination of the genitalia of the species of the genus *Phyciodes* Hübner most closely connected to these particular species of the genus *Melitaea* Fabricius has led to the reversal of the view that the species without an uncus, beginning with the glacial *M. asteria* Freyer and *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), have been the forerunners, and that *M. athalia* (Rottemburg) is the latest species culminating in *M. ambigua* Ménétriés from subtropical regions. This theory, which I had suggested in my paper of 1930 and Hormuzaki had sustained in 1934, must evidently be replaced by the usual one of parallelism, lately preferred by zoologists of all kinds, which agrees much better with the accepted view of the much older origin of these specific branches and with parallel frigoripetal transformations of some of them, which has culminated, comparatively recently, during the Glacial Periods, in such species as *M. asteria* Freyer.

Morphologically, by reason of the absence of an uncus in the male genitalia *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) seems to stand to *M. britomartis* Assmann as *M. deione* (Geyer) stands to *M. athalia* (Rottemburg). It must also be noted that—within the limits of specific variation—in *M. parthenie* (Borkhausen), collected in all sorts of localities in northern Italy, there are races in which the tegumen often exhibits two slight projections of its hind-edge or even two small chitinous knobs, which are evidently rudiments of the uncus, although they are placed farther apart from each other than are the corresponding processes of the uncus in any species when they are more developed. I figure the male genitalia of a specimen (pl. 14, fig. 326) of race *imitatrix* Verity taken at Turin, in which these processes are produced into two points to an extent I have never met with in any other example of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl). Rocci has illustrated these peculiar races, in detail (1922, *Mem. Soc. ent. ital.* 11 : 30; *id.*, 1933, *ibid.* 11 : 123). I can confirm these determinations because all Rocci's collection and his slides of the genital armatures are now in my possession and I have examined them carefully. The races with a rudiment of an uncus impressed him so much that he

actually took them for a distinct species and mistook them for race *aureliaeformis* Verity and, consequently, for *M. britomartis* Assmann, as I have mentioned it in connection with race *melathalia* Rocci. This action of his overrated considerably the value of this character, especially if one takes into account the fact that it only exists in a minor percentage of individuals, whilst in the majority of them not only can it not be seen (as Rocci himself remarks) but it actually does not exist. On the other hand, it does seem natural to group together all those races which exhibit this character occasionally and which were mistaken by Rocci for *M. britomartis* Assmann. I place them after the remaining races.

The variation of the general facies of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) is far less than that exhibited by *M. britomartis* Assmann and of *M. athalia* (Rottemburg); moreover, the variation which it does exhibit in the different regions and localities is never strikingly and constantly distinct, nor quite proper to any one region; for the various types blend together and mix individually to a considerable extent. Many are, no doubt, " somations," produced by the direct effect of surroundings on the individual development rather than true hereditary forms, but as I have no way of distinguishing them, I go on here applying the term of " race " to the population in the same way that I have done throughout the present paper.

There is an excellent monograph of this species by Frühstorfer (1919, *Arch. Naturg.* **83** (A) (3) : 170), who used the name *Melitaea aurelia* Nickerl for it; and for this reason and because I have myself described nearly all the races in detail and discussed their nomenclature at length in a special paper devoted to this subject (Verity, 1931, *Ent. Rec.* **43** : 154; *id.*, 1932, *ibid.* **44** : 27), I will abstain from repeating the whole of it here and I will give only a summary of the names and localities of the various races, together with a few remarks on the most important features which distinguish them. The general observation I have made above must serve to correct the somewhat too schematic impression which these few words of description might otherwise give.

(i) *MELITAEA PARTHENIE* Borkhausen race *NIGROBSCURA* Verity.

Pl. 6, figs. 147, 148 ♂♂, 149 ♀; Genitalia pl. 13, fig. 319.

Melitaea parthenie Borkhausen race *nigrobscura* Verity, 1931, *Ent. Rec.* **43** : 155.

This race is one of the most extreme and striking races produced by the species. It is of large size and highly melanic. It was figured under the erroneous name of *M. britomartis* Assmann by Osthelder (1925, *Mitt. münchn. ent. Ges.* **15** (suppl.) : 89, pl. 2, figs. 13, 16 ♂♂, 14, 15 ♀♀; pl. 3, figs. 1 ♂, 2, 3 ♀♀) from examples taken at Herrsching in southern Bavaria and others from Rohrseemoos, transitional to race *aurelia* Nickerl. Osthelder stated that this race spreads from the alpine valleys of that region to as far north as the Danube, at all altitudes, but he made a clear distinction between it and the smaller and darker " form of high altitudes," which he rightly refers to the following race. This very dark race will probably be found in suitable localities with damp surroundings, in many regions. It is, for instance, highly characterised and constant at Chiapovano, 600 m. to 1000 m., near Gorizia, coastland of the province of Udine. In this region, also, it is replaced by the smaller race *valsunga* Frühstorfer in the mountains (Carnic Alps).

When first publishing the name *nigrobscura* Verity, I expressly stated that I based the race so named upon the specimens from Herrsching figured by Osthelder; and this is therefore the type-locality of this race.

(ii) *MELITAEA PARTHENIE* Borkhausen race *VALSUNGA* Frühstorfer.

Pl. 9, fig. 245 ♂, 246 ♀; Genitalia pl. 13, fig. 319 (same specimen as that illustrated on fig. 245).

Melitaea aurelia valsunga Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 172.

This race was described from Barmsee in Upper Bavaria. The examples, which I figure on pl. 9, are the male holotype and female allotype from the Frühstorfer collection. They are identical with the pair figured by Hübner ([1799]–[1800], *Samml. europ. Schmett.* pl. *Pap.* 4 figs. 19 ♂, 20 ♀) under the name *Papilio athalia*. Osthelder figured a couple exhibiting still more markedly the characters of the smallest and darkest form. I possess perfectly similar examples taken at Evolena, 1500 m., in the Val d'Hérens (Upper Valais), where it evidently exists mixed with the following race as the most alpine representative of the species, and one of the specimens in my collection from the Pfynwald is like it too. This race is apparently widespread in the Alps, although very local; for it has been discovered lately by Rocci in the Carnic Alps, at the Forni Avoltri, 900 m., and Pè di Cleva, 1200 m., in Val Degano, and at Le Piane, 1600 m., in the Val Pesarina.

(iii) *MELITAEA PARTHENIE* Borkhausen race *MICROMELANICA* Verity.

Pl. 6, figs. 150 ♂, 151 ♀.

Melitaea parthenie (Borkhausen) race *micromelanica* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : (73).

I gave this name to the race as a whole which occurs in the Pfynwald in the Valais and extends a little to the north of the foot of the Val d'Hérens at an altitude of only 600 m. In size and by the extent of the black pattern it can be described as perfectly intermediate between race *valsunga* Frühstorfer and race *aurelia* Nickerl. What distinguishes it most strikingly from the former is the tone of the fulvous which has none of the rich red tinge characteristic of *valsunga* Frühstorfer, it being of the more usual shade seen in race *aurelia* Nickerl and most other races.

(iv) *MELITAEA PARTHENIE* Borkhausen race *AURELIA-NIGROBSCURA* Verity.

Melitaea parthenie Borkhausen race *aurelia-nigrobscura* Verity, 1931, *Ent. Rec.* **43** : 187.

In my original description of this race, I pointed out that the race of Vienna could be considered " a mixture of the northern and of the southern races of central Europe and can be adequately designated by the compound name of *aurelia-nigrobscura* Nick.–Vrty." This race is represented in my collection from Vienna; and, according to Osthelder, it occurs also at Regensburg and in the Jura. Vienna is the type-locality of this race, the holotype in my collection having been taken in that locality.

(v) *MELITAEA PARTHENIE* Borkhausen race *VIVIDOCOLORE* Verity.

Pl. 6, fig. 152 ♂.

Melitaea parthenie (Borkhausen) race *vividocolore* Verity, 1931, *Ent. Rec.* **43** : 186.

This race was described from an example taken at Kisnyir in Hungary. The holotype in my collection has a vivid red tone of fulvous such as I have seen in no example taken in any other region, even as an individual form. The black pattern is thin and sharply defined.

(vi) *MELITAEA PARTHENIE* Borkhausen race *AURELIA* Nickerl.

Pl. 6, figs. 153 ♂, 154 ♀.

Melitaea aurelia Nickerl, 1850, *Synopsis Lepid.-Faun. Böhmens* : 12.

This race, which was described from specimens taken in Bohemia, is widespread, occurring in a wide area north of the Danube. As contrasted with the two preceding races, it is smaller; the tone of colour is paler and duller; the pattern thinner and more like an even network over all the wings, thus giving the race a more uniform appearance.

(vii) *MELITAEA PARTHENIE* (Borkhausen) race *PARTHENIE* (Borkhausen).

Pl. 6, figs. 155 ♂, 156 ♂ (holotype of *lucasi* Verity), 157 ♀; Genitalia pl. 13, fig. 320 (same specimen as that illustrated on fig. 155).

This, the nominotypical, race of the species can fortunately be determined precisely, since (as shown on p. 663 above) the name *Papilio parthenie* Borkhausen was nothing but a nom. nov. pro the insect figured by Esper (pl. 89, fig. 1 (*nec* fig. 2)) under the name *Papilio athalia minor*. Esper stated that his specimen was taken at " Erlangen " in Franconia. Race *parthenie* (Borkhausen) is the smallest race of the species, and is characterised by the pale dull tone of the fulvous ground-colour, and by the extreme reduction of the black pattern. The two pre-marginal streaks are thin and stand away from one another; the central elbowed row of spots of the fore-wing is thin and partly obliterated in its central portion; and the whole pattern is greyish rather than black. This race is obviously the " dry somation " produced by unfavourable conditions acting on a constitution similar to that of race *aurelia* Nickerl. I figure a similar specimen from Dresden (pl. 6, fig. 155). In 1909, Oberthür published the MS. name *serotina* originally proposed by Guenée for examples of what is now known to be the nominotypical race. Guenée's specimens were taken in France in the Forêt de Vibraye. Before I realised what was the nominotypical race I described it as a race very distinct from race *aurelia* Nickerl and gave it the name *lucasi* Verity. That name was based on specimens taken on 28th June on the Plateau St. Claude, near Moreuil (Oise), then a new French locality for the species.

(viii) *MELITAEA PARTHENIE* (Borkhausen) race (or races) occurring in the U.S.S.R.

No information is, to my knowledge, available regarding the aspect of the Russian races, the existence of which in the neighbourhood of Moscow and in

the Southern Ural Mountains has been established by Suschkin through examination of the male genitalia.

(ix) *MELITAEA PARTHENIE* (Borkhausen) race *RHAETICA* Frey.

Pl. 6, fig. 158 ♂; Genitalia pl. 13, fig. 321.

Melitaea aurelia Nickerl var. *rhaetica* Frey, 1880, *Lep. Schweiz* : 30.

The typical locality of this race is Chur in the Grisons. Frey stated that his examples were taken at 700 m. and that the range of elevation at which this insect occurred was very limited. Frey's description of this insect was inadequate; and the characters of this race remained imperfectly known until Frühstorfer (1919) at last furnished proper information and made it possible to use the name in a definite and correct way. It has turned out that the male described by Frey is more or less similar to the nominotypical *parthenie* (Borkhausen) as defined above; and that the characteristic of race *rhaetica* Frey is afforded by the striking and really peculiar form of the female, which is very variegated owing to some large clear yellowish spaces contrasting with the deep reddish fulvous of the others. This characteristic was included in Frey's description, for he said "the female not uncommonly with very light brown rows of spots." This is therefore the typical individual form of race *rhaetica* Frey. Variation, however, is enormous in both sexes, and some males are even as melanic as those of race *valsunga* Frühstorfer.

(x) *MELITAEA PARTHENIE* Borkhausen race *POENINA* Verity.

Pl. 6, figs. 159–161 ♂♂, 162 ♀.

Melitaea parthenie Borkhausen race *poenina* Verity, 1931, *Ent. Rec.* **43** : 188.

This race, the type of which was taken by myself at the Second Refuge (1400 m.) below Bérisal in the Upper Valais, produces some individuals similar to race *rhaetica* Frey, and, like that race, varies enormously. The trend of variation is, however, in a different direction. Race *poenina* Verity may be regarded as forming a transition between race *rhaetica* Frey on the one hand and the *aurelia*-like race of the Lower Valais. It never produces any markedly alpine-like form of the female, which (as explained above) is the characteristic of race *rhaetica* Frey. It stands, indeed, to that race very much as does race *variabella* Verity to the nominotypical race of *M. varia* Herrich-Schäffer of the eastern Alps.

I come now to the group of races which fly exclusively on the southern watershed of the Alps. One of the peculiarities of this group of races is that, at low altitudes, it produces a second generation, at the end of August, often quite as abundant as the first which flies in May and June. Taken as a whole, this group differs in a comparatively very distinct way from all the races described above. The wings are, on an average, shorter and rounder at the apex; the fulvous is more even in tone and less variable; the black pattern is, on the contrary, less uniform; and in particular the central elbowed row of spots tends to form a broad band, whereas the premarginal bands tend to be thinner. These features all contribute to give these races a more *athalia*-like aspect than one ever finds in the others. Some individuals may even be so like one or other of that species as to make it quite difficult to separate them without the aid of the genitalia. It is amongst these races that Rocci has observed those with

a rudiment of an uncus. The races, which are never so characterised, are according to Rocci, the three immediately following.

(xi) *MELITAEA PARTHENIE* Borkhausen race *CARSICOLA* Verity.

Pl. 6, figs. 163, 164 ♂♂; (form aest. *postcarsicola* Verity) figs. 165, 165 *bis* ♂♂.

Melitaea parthenie Borkhausen race *carsicola* Verity, 1932, *Ent. Rec.* **44**: 29; *Melitaea parthenie* Borkhausen race *carsicola* Verity form (gen. aest.) *postcarsicola* Verity, 1932, *ibid.* **44**: 29.

This race was described from specimens found (rather surprisingly) on the dry table-land of the Carso, 300 m., near Trieste at Opcina. The spring generation attains the largest size that I have seen in any other race, some males having fore-wings of 18 mm. in length, whereas the late summer generation produces some extremely minute individuals of only 14 mm. The usual size is 17 mm. in the first and 16 mm. in the second generation. A feature which strikes one in both generations is the far smaller degree of variability than in other races. The fulvous is, very uniformly, rather clear, but decidedly dull; the black pattern very regular and of the same even breadth across all the wing; the females belong to the form most similar to the male and the darker forms never occur, as they do farther east, in Austria. The second generation is paler, has a thinner black pattern and a lighter coloured basal suffusion. Stauder figures three abnormal specimens of the race (1922, *Z. wiss. InsectenBiol.* **17** : 83).

(xii) *MELITAEA PARTHENIE* Borkhausen race *MUSSINAE* Costantini.

Pl. 7, figs. 166 ♂, 167 ♀; Genitalia pl. 13, fig. 322 (same examples as that illustrated on fig. 166).

Melitaea aurelia Nickerl var. *mussinae* Costantini, 1916, *Atti Soc. nat. Modena* (5) **3** : 14.

This race was described from specimens taken at La Mussina, near Borzano, in the province of Reggio Emilia. The typical material taken in June is now in my collection. It can be said to differ from the second generation of the Carso (form *postcarsicola* Verity of race *carsicola* Verity) by its larger size (not equal, however, to that of the first generation of that race) and by the black pattern being thicker than in the darkest specimens of it. On the other hand, it is far from being as dark as many examples of race *imitatrix* Verity from Oulx. Thus the general aspect of this race can be described as intermediate between that of races *carsicola* Verity and *imitatrix* Verity.

(xiii) *MELITAEA PARTHENIE* Borkhausen race *LUCERIA* Frühstorfer.

Pl. 9, figs. 242–244 ♂♂; Genitalia pl. 13, fig. 323 (same specimen as that illustrated on fig. 242).

Melitaea aurelia luceria Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2) : 11.

This race was described from specimens taken at Cogne in the Aosta Valley. It is a large alpine race with very extensive and bright fulvous spaces, which Frühstorfer stated were " nearly exactly like Seitz's figure of *mongolica* on pl. 66h." I figure three of Frühstorfer's specimens, the third of which (pl. 9,

fig. 244) is labelled " type." The latter very clearly exhibits the character cited by Frühstorfer.

The following races are those which in some individuals have a rudimentary uncus to the male genitalia, as may be seen from the figures which I give.

(xiv) *MELITAEA PARTHENIE* Borkhausen race *IMITATRIX* Verity.

Pl. 7, figs. 168, 169 ♂♂; Genitalia pl. 13, figs. 324 (same specimen as that illustrated on fig. 168), 325; pl. 14, fig. 326 (same specimen as that illustrated on fig. 169).

Melitaea parthenie Borkhausen race *imitatrix* Verity, 1932, *Ent. Rec.* **44** : 28; *Melitaea britomartis* Assmann form (razza) *segusiana* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 38.

I described this race from a long series taken by myself at Oulx, 1100 m., in the Susa Valley, and from a second series taken on Mount Mussinè, 1000 m., at the foot of that valley. This race is widespread in that valley up to Bardonecchia; and it extends downwards to the Venaria Park at Turin. It was specimens from this last-named locality that Rocci misidentified with race *aureliaeformis* Verity of *M. britomartis* Assmann. The two races of these very distinct species are in fact so similar superficially that definite identification can only be established by the examination of the male genitalia. The examples of race *imitatrix* Verity from the Venaria Park were figured by Rocci under the name *aureliaeformis* Verity (1932, *Mem. Soc. ent. ital.* **11** : 143, fig. vi; *ibid.* : 152, fig. xii). I figure (pl. 7, fig. 169, and genitalia pl. 14, fig. 326) a male with a more developed uncus than I have seen elsewhere in this species anywhere. To the naked eye race *imitatrix* Verity can be described as small in size with a rich tone of fulvous (not bright) and a rather heavy black pattern, as compared to the other races of the southern watershed of the Alps, with the exception of races *nigrobscura* Verity and *valsunga* Frühstorfer. It is thus exactly the opposite of race *luceria* Frühstorfer. The females are almost invariably of the form most nearly resembling the male.

Rocci (1932) stated that it was his intention to give the name *segusiana* Rocci to this race, before he realised that I had given it the name *imitatrix* Verity, of which therefore *segusiana* Rocci is a synonym.

(xv) *MELITAEA PARTHENIE* Borkhausen race *VERBANICA* Rocci.

Pl. 7, figs. 170 ♂, 171 ♀; Genitalia pl. 14, fig. 328 (same specimen as that illustrated on fig. 170).

Melitaea britomartis Assmann form (razza) *verbanica* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 39, 152 (fig. of genit.).

This race, which may be regarded as the damp somation of race *mendrisiota* Frühstorfer, was described from specimens taken at Valtravaglia (700–900 m.) on the Lombard side of the Lake Maggiore. It has a completely different appearance from race *mendrisiota* Frühstorfer, although these two races inhabit neighbouring regions. There is therefore little doubt that race *verbanica* Rocci is nothing but a representative of race *mendrisiota* Frühstorfer, modified by surrounding factors. The fulvous ground-colour is deeper in tone; the black markings are thicker and much more even; and all the markings of the underside stand out more sharply and boldly. In other words, race *verbanica* Rocci clearly has an aspect intermediate between races *imitatrix* Verity and

mendrisiota Frühstorfer. This " damp " race is evidently characteristic of the whole of the Prealps; for I have a large series collected by L. Rocca in the Venetian Alps at Belluno (I Piai, 450 m., near Mas in Val Cordevole), at the beginning of August, which differs in no way from the series of paratypes in my collection. The same is true also of a very worn series taken in mid-June at Ponte nelle Alpi, in Val Piave near Belluno. The latter seems to suggest that there are two generations in that locality, as there are farther east, on the Carso, in race *carsicola* Verity described above.

(xvi) *MELITAEA PARTHENIE* Borkhausen race *MENDRISIOTA* Frühstorfer.

Pl. 9, figs. 247–249 ♂♂, 250, 251 ♀♀; Genitalia pl. 14, fig. 327 (same specimen as that illustrated on fig. 247).

Melitaea aurelia mendrisiota Frühstorfer, 1919, *Archiv Naturges.* **83** (A) (3) : 175; *Melitaea britomartis* Assmann form (razza) *lacustris* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 39; *id.*, 1933, *ibid.* **11** : 143, 144, fig. 6B.

This race, as noted above, is the dry somation of race *verbanica* Rocci. It occurs in the arid mountains of the Canton Tessin. The type was taken at 600 m. altitude on Mt. Generoso, south of Lugano, end of June. This race occurs also in adjacent regions, such as the Brianza, from which locality I possess highly characterised specimens of it. The typical series now in the Paris Museum shows considerable variation and many specimens do not possess the characteristic facies described by Frühstorfer, who considered that the black pattern was thinner in this than in any other race of the species. I now know, however, that the following Italian races are more extreme in this sense and that race *mendrisiota* Frühstorfer is only a race transitional to them. Even so, Frühstorfer pointed out that in race *mendrisiota* Frühstorfer there are some males in which the inner premarginal streak can be said to be effaced. In the females he noted the fulvous varies to light yellow or to reddish-brown, but always uniformly, the two colours never being mixed as in race *rhaetica* Frey.

This dry somation, like its damp counterpart race *verbanica* Rocci, occurs as far as the Eastern Alps. I cannot detect any differences between it and a series of specimens collected, at the unusually early date of 8th May, on the hills between Desenzano and Salo, on the Lombard side of the Lake of Garda, which Rocci separated as race *lacustris* Rocci. I can only say that in the latter series the extreme lightly coloured and thinly marked form is more constant than in race *mendrisiota* Frühstorfer.

(xvii) *MELITAEA PARTHENIE* Borkhausen race *LIGUSTICA* Rocci.

Melitaea britomartis Assmann form (razza) *ligustica* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 37; *id.*, 1933, *ibid.* **11** : 143, 144 fig. 5 (right-hand fig.) (genit.).

This race, which was described from specimens taken in the Ligurian Apennines in the Val Bisagno, from 600–700 m., and at Savignano, in the Val Scrivia, is a near approach to race *mussinae* Costantini, described from farther east in the same chain of mountains in Emilia. It is not as constantly pale and thinly marked as the last-named race because it is more variable. It is evidently transitional, by its opposite individual variations to the Piedmontese races. It can therefore properly be kept separate from race *mussinae* Costantini. If it is confirmed that in the latter the male genitalia never have any trace of uncus, whereas some examples of race *ligustica* Rocci do as believed by that

author, there will be another good reason for treating the two races as distinct from one another.

9. *MELITAEA VERONICAE* Dorfmeister.

Melitaea veronicae Dorfmeister, 1853, *Verh. zool.-bot. Ver. Wien* **3** (*SitzBer.*) : 137.

This insect was described by Dorfmeister from specimens bred from larvae taken at Bruck a. d. Mur in Styria, which he noted differed from the larvae of *Melitaea aurelia* Nickerl (*i.e.* of *Melitaea parthenie* (Borkhausen)). The name was treated by Lederer (1853, *Verh. zool.-bot. Ver. Wien* **3** : 357) and subsequent authors as a synonym of *Melitaea britomartis* Assmann, and it remained entirely neglected until Hormuzaki found at Ahornbühl, near Ischl to the east of Salzburg, a number of males and some larvae which agreed perfectly with Dorfmeister's original description. Having examined the male genital armature of these specimens, Hormuzaki found that they stood nearest to those of *Melitaea parthenie* (Borkhausen) (= *aurelia* Nickerl) by reason of the complete lack of an uncus. In other respects, however, the genitalia of these examples differed considerably from those of *Melitaea parthenie* (Borkhausen). Hormuzaki described and figured these examples in 1925 (*N. Beitr. syst. InsektenK.* **3** : 75); and in 1934 (*Bul. Facult. Stiint. Cernaute* **4** : 51) he again dealt with this insect and confirmed his opinion that it could only be treated as a distinct species. I am not myself acquainted with this insect, and I can only quote Hormuzaki's conclusion and summarise his descriptions.

Hormuzaki stated that *Melitaea parthenie* (Borkhausen) occurred sparingly in the localities in which he captured *M. veronicae* Dorfmeister; but that the first-named species was on the wing in early June, when only larvae of *M. veronicae* Dorfmeister were to be found, the latter species not emerging until the 29th of that month.

The genitalia of *M. veronicae* Dorfmeister are characterised by being larger in relation to the size of the insect than are those of *M. parthenie* (Borkhausen); by the extremely short tegumen with a concave hind-margin, the result being that that structure is less short at the sides and shaped like a saddle, as in the figures given by Rebel of the genitalia of *M. deione* Geyer race *rosinae* Rebel. Further, in *M. veronicae* Dorfmeister the harpe is much larger than in *M. parthenie* (Borkhausen), being thinner and either bent sharply towards the middle or sickle-shaped with spines up to the apex. The terminal apophysis is even broader than in the latter species. The end of the aedeagus is thicker, but curved upwards in the same way. The features visible to the naked eye, in the imago, are only the larger size as compared with either *M. parthenie* (Borkhausen) or *M. britomartis* Assmann and the general appearance of the underside of the hind-wings which is very similar to that of *M. diamina* (Lang) (= *dictynna* Esper), a character very frequent also in *M. britomartis* Assmann, but stated never to be exhibited by *M. parthenie* (Borkhausen). The chief morphological peculiarity of *M. veronicae* Dorfmeister consists therefore in the conjunction of this type of pattern with the absence of an uncus.

10. *MELITAEA ASTERIA* Freyer.

Melitaea asteria Freyer, 1828, *Beitr. Gesch. europ. Schmett.* **1** (6) : 115, pl. 3, fig. 1 ♂.

I have already referred at several points to this glacial insect, when discussing the connections between the various species dealt with and their presumed

phylogenetic positions. Up to the time of the acceptance of the theory that the palaearctic fauna had been almost entirely derived from ancestors which had acquired their peculiar constitutions during the Glacial Periods, *M. asteria* Freyer was regarded as the most ancient species of this group of the genus *Melitaea* Fabricius; and the comparatively simple structure of its genital armature was interpreted as representing the elementary type from which all the others had been derived as they developed an increasing complexity through caloripetal variation. Recently this view has, however, had to be entirely discarded, since it has been realised that the history of the earth is one of progressive cooling and that most of the species living were produced in the Polar Continent under temperate conditions long before the Glacial Periods came into existence, *i.e.* during and before the Miocene Period, as far back as the Cretaceous, from still more ancient tropical and then subtropical species and exerges. Judged from this standpoint, *M. asteria* Freyer represents one of the most extreme degrees of frigoripetal variation, presumably attained during the climax of widespread glacial climate of the Glacial Periods of the Quaternary. The simple structure of its genitalia must, therefore, be taken as the result of incomplete development through the effects of very cold surroundings. Just as the whole insect is frail and the wings of the female usually lack stiffness, so does, in fact, the genital armature, which creases and folds much more freely than does that of the other species of the group during the process of mounting it for microscopic purposes. I have already remarked at the beginning of the paper that this conclusion is consistent also with the complex genitalic structure of the male genital armature of subtropical species of the genus *Phyciodes* Hübner, *i.e.* the species of that genus most closely connected to these species of the genus *Melitaea* Fabricius, thus showing that the latter must have derived their characters from this section of the genus *Phyciodes* Hübner.

On comparing the genitalia of *M. asteria* Freyer with those of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), one is at once struck by the fact that they are, fundamentally, quite alike. The differences are that the valves are somewhat more oval; the harpe has very few and very tiny teeth; and the terminal apophysis is much more slightly indented and simpler in structure, because the plateau of its forepart is scarcely perceptible and the hindpart only has the two terminal spines well developed, or even a single one left, as in the specimen figured by Reverdin (1927, *Bull. Soc. lép. Genève* **5** : 166). The aedeagus, furthermore, shows the close connection of the two species, because that of *M. asteria* Freyer belongs to exactly the same peculiar type as that of *M. parthenie* (Borkhausen). The differences in the general facies of European examples of *M. asteria* Freyer are the smaller size, frailer build, thinner scaling and greater melanism. On the underside of the hind-wing the white spaces are very silvery and the premarginal ones very large; the russet markings are dark and lesser in extent. The character which some text-books give as being the chief specific peculiarity is the lack of the second capillary streak along the outer margin; but this is not correct, for there exist specimens in which the character is perfectly detectable. The extent of the premarginal white spaces and the fact that they exist also on the fore-wing and stretch as far as the tornus seem to constitute a more important feature, although, as I have shown, they are not peculiar to *M. asteria* Freyer; for they occur, and they are racial, in race *septentriorientis* Verity of *M. britomartis* Assmann. As may presently be seen, the asiatic *rebeli* Wnukowsky of *M. asteria* Freyer is not so distinct. A further feature of *M. asteria* Freyer is its peculiar rushing flight, well suited

to meet the strong winds of the high altitudes at which it lives, its localities being exclusively near the outskirts of the largest glaciers.

The distribution of this insect is somewhat remarkable, as it is only known to occur in the Altai Mts. in western Siberia, and in the eastern Alps of central Europe (very doubtfully as far west as the Cottian Alps), although, of course, the enormous gap between its two colonies is well recognised and frequently observed in connection with a great many glacial plants and animals, including the chamois.

For all these reasons it may be taken that this species has derived from very much the same phylum as *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), but that it has faced glacial surroundings and lived in them since the periods of this sort in the Pleistocene, and in consequence has been permanently modified, constitutionally, in a hereditary way, which cannot, apparently, revert to the constitution suited to more temperate climates. This last inference can be drawn from the fact that no transitions, either geographical or even individual, have been recorded between them. Unless they are discovered some day, as has happened with race *frigescens* Verity, which is intermediate between exerge *glaciegenita* Verity (= *merope* Prunner, auct. *nec* Prunner) and the nominotypical exerge of *E. aurinia* (Rottemburg), one, therefore, seems justified in believing that there exists a specific degree of distinction between *M. asteria* Freyer and *M. parthenie* (Borkhausen), although one has no proofs of sterility between them, because they are too different to stand one another's surroundings and never overlap in intermediate zones and interbreed, as exerges do, *e.g.* exerges *helvetica* Rühl (= *pseudathalia* Reverdin) and *athalia* (Rottemburg) of *M. athalia* (Rottemburg). On the other hand, *M. asteria* Freyer has certainly not been derived, in a direct way, from *M. parthenie* (Borkhausen) because race *rebeli* Wnukowsky, the asiatic representative of *M. asteria* Freyer, clearly shows the direct connection of the latter with *M. britomartis* Assmann both by the presence of a small uncus on the tegumen of the male genitalia and by the structure and aspect of the whole insect, which is much more similar to races *frigidaltaica* Verity and *centralasiae* Wnukowsky of *M. britomartis* Assmann than to any race of *M. parthenie* (Borkhausen). So, therefore, in this case also, as usual, one must conclude that the highly characterised European races of *M. asteria* Freyer may have been derived from ancestors similar to race *rebeli* Wnukowsky, but that *M. parthenie* (Borkhausen) can only belong to another parallel phylum which escaped glacial conditions to a far greater extent, as will be presently mentioned.

It is very interesting to note that exactly the same relationship exists in the connections between *M. varia* Herrich-Schäffer and *M. parthenoides* Keferstein dealt with below. Here too the glacial *M. varia* Herrich-Schäffer has a frailer build and male genitalia still more distinct from those of *M. parthenoides* Keferstein, owing to simpler structure (no uncus, no spines on the harpe, or tiny ones, no dents on the fore-edge of the terminal process), but the same couple of large diverging spines on the hindpart of the terminal process as in *M. asteria* Freyer. There are no transitional forms, although *M. parthenoides* Keferstein can live very near glaciers and takes the place of *M. varia* Herrich-Schäffer entirely and acquires even its general facies in the Pyrenees and in the higher mountains in Spain, thus showing how *M. varia* Herrich-Schäffer may have been derived from it or from some genetically intermediate form, by a more thorough adaptation attained gradually, during the long periods of glaciation, where no escape to milder lands was possible.

The unusual fact to be noticed in these two cases is that the more primitive

forms of temperate climates, *i.e. M. parthenie* (Borkhausen) (= *aurelia* Nickerl) and *M. parthenoides* Keferstein should not exist in Asia, whence they must presumably have come by the northern Sibero–Russian route in comparatively recent times after the periods of glaciation, for they have no connections with the Mediterranean fauna of Miocene origin, like exerge *helvetica* Rühl of *M. athalia* (Rottemburg) or *M. deione* (Geyer), which needed still milder surroundings and which have survived in the suitable western maritime climate the cold periods which they could not face in Asia. The most likely explanation is perhaps that *M. parthenie* (Borkhausen) and *M. parthenoides* Keferstein became extinct in that continent during and after the Pleistocene by the increasing drought rather than by the cold, when, after the Hai Hai sea had turned into dry table-lands and the great sea channel between Europe and Asia was reduced to the Caspian Sea alone at the end of the Pleistocene, many plants and animals survived by spreading to more suitable lands in Europe, by the new northern route thus opened out to migrations.

The two regions inhabited by *M. asteria* Freyer, to which I have referred above, account by their very limited extents for its lack of geographical variation; but on the whole the asiatic race is, as might be expected, very much less highly specialised and less distinct from its close ally *M. britomartis* race *frigidaltaica* Verity than is the European colony. As a matter of fact, the latter more closely resembles *M. parthenie* (Borkhausen) especially by its genital armature, so that it seems to have undergone a process of evolution parallel to it when the two species spread westwards. What is particularly remarkable is the presence of a small but distinct uncus in the Altai race, and the total and constant absence of it in the European one, just as *M. parthenie* (Borkhausen), which has no uncus either, is proper to the latter region. It will also be noticed by comparing the figures of the genitalia which I give that the asiatic race has preserved more of the plateau of the terminal processes of the valves, with a well-marked dent in its forepart, such as is to be seen in the allied species.

(i) *MELITAEA ASTERIA* Freyer race *REBELI* Wnukowsky.

Genitalia pl. 14, fig. 330.

Melitaea asteria rebeli Wnukowsky, 1929, *Zool. Anz.* **83**: 222 (nom. nov. pro *Melitaea asteria* Freyer var. *altaica* Staudinger, 1901); *Melitaea asteria* Freyer var. *altaica* Staudinger, 1901, *Cat. Lep. pal. Faunengeb.*: **34** (homonym of *Melitaea didyma* Esper var. *altaica* Grum-Grshimaïlo, 1893, *Hor. Soc. ent. ross.* **27**: 127).

This race was described by Staudinger from examples taken in the Tschuja Mountains (2100–2400 m.) in the massiv of the Altai. It is less highly characterised than nominotypical *asteria* Freyer. Externally also it is not so small or so frail as the last-named race; the extent of the fulvous is much less reduced by the black suffusions on the upperside; the black pattern of the fore-wings is not as thin on the underside; and the inner capillary streak of the hind-wing is not obliterated, which is noteworthy because when it was thought that this species was confined to Europe this was regarded as the specific and most characteristic feature of the species.

Staudinger's type series was taken by Elwes, who treated this insect as being referable to *M. aurelia* Nickerl (*i.e.* to *M. parthenie* (Borkhausen)) (see Elwes, 1899, *Trans. ent. Soc. Lond.* **1899**: 334). Higgins very kindly examined for me the series of Elwes's examples in the British Museum (Natural History), and informed me that they looked very different from European examples of *M. asteria* Freyer. I therefore asked Mr. N. D. Riley to furnish me with

photographs and to examine the male genitalia. The slide which was accordingly prepared has enabled me definitely to confirm Staudinger's identification of this insect as a race of *M. asteria* Freyer, unless it is considered preferable to treat it as a distinct but closely allied species. I personally prefer the former view.

(ii) *MELITAEA ASTERIA* Freyer race *ASTERIA* Freyer.

Pl. 7, figs. 172, 174 ♂♂, 173 ♀; Genitalia pl. 14, fig. 329.

Freyer stated that this insect was described from specimens taken in the neighbourhood of Chur. It is not necessary to give a separate description of this race, since its characters have been fully explained in the account given above of race *rebeli* Wnukowsky.

(iii) *MELITAEA ASTERIA* Freyer race *MEVANIA* Frühstorfer.

Melitaea asteria mevania Frühstorfer, 1910, *Ent. Z.* **24** : 144.

This race was based on examples taken at the Gross-Glockner. It is more melanic than nominotypical *asteria* Freyer; the black suffusion at the base of the wings is more extensive; there are two rows of spaces remaining on the hind-wing, those on the fore-wing being very small; these spaces are, moreover, of a reddish-brown instead of a yellowish-grey colour; and on the underside the black markings are thicker.

11. *MELITAEA PARTHENOIDES* Keferstein

(commonly but erroneously known as *Melitaea parthenie* (Borkhausen)).

Melitaea parthenoides Keferstein, 1851, *Ent. Z., Stettin* **12** : 244 (nom. nov. pro *Melitaea parthenie* Borkhausen, Godart *nec* Borkhausen, 1822, *Hist. nat. Lép. France* **2** : 75, pl. 9, figs. 7, 8); *Melitaea parthenie* Borkhausen race *inanis* Verity; 1921, *Ent. Rec.* **33** : 213–214; *Melitaea parthenoides* Keferstein race *completa* form. vern. *communis* Verity, 1931, *Ent. Rec.* **43** : 137.

As I have already explained, the nomenclature of this species is interlocked with that of *Melitaea parthenie* (Borkhausen) (= *aurelia* Nickerl). I dealt with this matter fully in 1931 (*Ent. Rec.* **43** : 100), and it is only necessary here to explain that the discovery that *Papilio parthenie* Borkhausen is the oldest name for the species until then universally known as *Melitaea aurelia* Nickerl made it necessary to find the appropriate name for the species equally universally known until then as *Melitaea parthenie* (Borkhausen). The oldest available name for the latter species was found to be *Melitaea parthenoides* Keferstein, and that name was accordingly brought into use.

As regards the systematic position of *M. parthenoides* Keferstein in the *athalia*-group of the genus *Melitaea* Fabricius, it may be said that this species stands somewhat apart from all the preceding ones. It gives the impression of being intermediate between these species on the one hand and on the other hand *M. baikalensis* Bremer, 1861 (= *M. arcesia* Bremer, 1861) and *M. sindura* Moore, to which it seems morphologically connected by *M. varia* Herrich-Schäffer and still more so by the Asiatic species *M. alatauica* Staudinger. Some examples of the two first-named species resemble examples of the two last-named species and of *M. parthenoides* Keferstein so closely to the naked eye that Seitz, who had no knowledge of their genitalia, declared himself unable to draw the line between them. In 1930 (*Ent. Rec.* **42** : 53–54 and 71–75), I discussed the relationship between these various groups, pointing out that the examination of the male genitalia have revealed an affinity between *M. minerva*

Staudinger, 1881, and *M. baikalensis* Bremer to those of *M. diamina* (Lang) (= *dictynna* Esper) on the one hand and to those of *M. cinxia* (Linnaeus) on the other. The first of these affinities is confirmed also by characters visible to the naked eye. I drew the conclusion that *M. baikalensis* Bremer and *M. sindura* Moore are more primitive than the species of the *athalia*-group, which has been derived from them and become more distinct from the other parallel lines than they are, by a Palaearctic outburst, only equalled, in the genus *Melitaea* Fabricius, by that seen in the *didyma* line of descent. Although it may be questioned whether *M. athalia* (Rottemburg) and the rest of its group have in distant times and possibly in the Polar Continent actually passed through stages genitalically similar first to *M. baikalensis* Bremer and *M. sindura* Moore and then to *M. parthenoides* Keferstein and *M. varia* Herrich-Schäffer, it is certain that the two latter species are less highly specialised and characteristic than the rest of the species of the *athalia*-group. It must also be remembered that a closer connection than might have been suspected may exist between *M. parthenoides* Keferstein and *M. athalia* (Rottemburg), in view of the way in which the latter reproduces exactly the general facies of the former in race *parthenoidemima* Verity and recalls it very much in race *anatolica* Wagner and other races of eastern Europe, the same being true also in some features of the male genital armature.

The chief characteristic of the genitalia of *M. parthenoides* Keferstein is afforded by the shape of the terminal apophysis of the valves, which is triangular with a broad base and tapers rapidly into a single very sharp point, which is bent forward. The concave fore-edge is indented into a series of numerous, but very tiny teeth. The convex hind-edge is smooth, and at its base it passes, with a very slight and long-drawn curve, into the following concave part of the hind-edge of the valves. The slightness of that curve is a very constant and useful distinctive feature in this species, because in the others it is markedly more pronounced and in *M. athalia* (Rottemburg), in particular, it nearly forms a right angle. The smoothness of this apophysis, owing to the lack of angles, dents, and spines, is what sustains, so far as concerns the genitalia, the relationship of this species with *M. baikalensis* Bremer and *M. sindura* Moore, which have a still smoother thinner and larger one.

The second distinctive feature of *M. parthenoides* Keferstein is to be found in the shape of the uncus, which is strikingly like that of the mandible of some species of Coleoptera, because the thin sharp ends of the two processes are bent inwards towards each other, but, as I have shown, this is often the case in exerge *athalia* (Rottemburg) of *M. athalia* (Rottemburg). The tegumen is always short and usually crescent-shaped. The valves are more globular than in most examples of *M. athalia* (Rottemburg). The harpe is distinctly shorter and thicker than is usual in the latter species and more like the longest example of *M. britomartis* Assmann, since they also have pronounced teeth and often very large ones. Further, also the aedeagus is very much as in *M. britomartis* Assmann.

As regards the distinctive features of *M. parthenoides* Keferstein visible to the naked eye, there is not much that can be defined exactly; and there are no features exclusively confined to this species which can be relied on, in all cases, to distinguish it from *M. athalia* (Rottemburg). As a rule, the palpi afford a good distinctive character in that they are red, when viewed from above, as in *M. parthenie* (Borkhausen) (= *aurelia* Nickerl), but this distinction breaks down in many individuals. On the upperside of the wings the pattern is, on the average, more regular than in *M. athalia* (Rottemburg) but not of

such an even thickness as in *M. parthenie* (Borkhausen). The best character, however, is afforded by the considerable breadth of the fulvous space between the central elbowed row of black spots or band and the inner submarginal band, especially in its median portion and on the hind-wing. Unfortunately, there are races of *M. athalia* (Rottemburg) which produce this feature also not uncommonly, especially those of exerge *helvetica* Rühl, which fly with *M. parthenoides* Keferstein in France, Spain and Switzerland. The females are, usually, more readily distinguishable because most of them are more melanic than those of exerge *helvetica* Rühl of *M. athalia* (Rottemburg) and more variegated, on account of light, yellowish premarginal spaces. On the underside, most females exhibit an almost complete obliteration of the markings of the fore-wings, except the premarginal ones. These in both sexes consist in low and even arches, including the one between the third median and the first cubital nervure, which, in *M. athalia* (Rottemburg), projects, on the contrary, farther inwards than the others in a characteristic way. The underside has constantly the harder and stiffer-looking markings which I have described in the exceptional races of *M. athalia* (Rottemburg), only found in the east of Europe. These markings are also more uniform all over the wing, chiefly owing to the uniform thickness of the black streaks which are rather thicker than in the other species.

The geographical distribution of this species is rather unusual and limited in extent, namely—southern Germany, Bohemia, Moravia, and Hungary, to the east; it does not extend to Scandinavia to the north, nor does it pass the water-parting of the Alps, even exceptionally, to the south as does *M. parthenie* (Borkhausen) (= *aurelia* Nickerl); westwards, on the contrary, it stretches much farther than does *M. parthenie* (Borkhausen), extending to the whole of France and to Spain, as far as the Castiles. It thus follows strictly the southern portion of the route of the northern exerge of more widespread species, but it has become extinct in the whole of the Asiatic and Russian portion of its former area of distribution.

In central Europe, *M. parthenoides* Keferstein varies, locally, considerably more than its nearest allies. There is, first of all, a broad range of variation within the same territories, evidently produced by differences of surroundings in the various localities and especially by the amount of dampness or of aridity. One clearly detects in that region three fundamental types which are, as a rule, locally racial in the broad sense of the word: their distinct facies are chiefly due to size, shape of wings, tone of colour and more particularly to the extent of the black pattern on both surfaces.

In view of the fact that I dealt fully with the variation of this species in a paper published in 1931 (*Ent. Rec.* **43**), I propose here to follow the course which I have adopted in the case of *M. parthenie* (Borkhausen) (= *aurelia* Nickerl) and to confine myself to giving brief summarised descriptions of the various races.

(i) *MELITAEA PARTHENOIDES* Keferstein race *PARTHENOIDES* Keferstein.

Pl. 7, figs. 175 ♂, 176 ♀ (paratypes of *inanis* Verity); figs. 177, 179 ♂♂, 178 ♀ (Gen. I form *communis* Verity); Genitalia pl. 14, figs. 331 (same example as that illustrated on fig. 175), 332 (same example as that illustrated on fig. 179).

As I have already explained, Keferstein based this name on figures given (under the name *parthenie*) by Godart on pl. 9 (figs. 7 and 8) of his *Hist. nat.*

Lép. France. Godart stated that his insect occurred at Havre, Chartres and Auxerre; and these are therefore the typical localities of nominotypical *M. parthenoides* Keferstein. The actual figure given by Godart represents a decidedly unusual form of very small size, with short stumpy wings, a dull pale tone of fulvous and a very thin, though complete, black pattern.

A series of specimens of the second generation taken at Pont de l'Arche (Department of the Eure), sent to me by Dupont, possess this curious appearance; and it was for this reason that I gave the name *inanis* Verity to this insect, not having realised at that time that the name *parthenoides* Keferstein properly applied to it. The first generation of the Pont de l'Arche race belonged to the widespread race which at that time was universally known as *M. parthenie* (Borkhausen). Later I described this spring form under the name *communis* Verity. The types in my collection of this form were taken at Angers (Maine-et-Loire). I added that Oberthür had figured an identically similar couple (1910, *Et. Lép. comp.* **4**: 671–672, pl. 144, figs. 347 *bis*, 347 *ter.*). Seitz (*Gross-schmett. Erde* **1**) and Rebel (*in* Berge, *SchmettBuch*) figured a similar insect, except that the richer and brighter fulvous in their figures recalls somewhat examples from more southern localities, *e.g.* examples of races *sphines* Frühstorfer and *semiplena* Verity.

(ii) *MELITAEA PARTHENOIDES* Keferstein race *COMPLETA* Verity.

Pl. 7, fig. 180 ♂.

Melitaea parthenoides Keferstein race *completa* Verity, 1931, *Ent. Rec.* **43**: 136.

This is the widespread race in which the second generation is quite different from the corresponding generation of nominotypical *parthenoides* Keferstein, described above. It is not so small; the wings are very much more elongated and pointed; the tone of colour is richer and the pattern bolder in both sexes. I took as typical of this race an August series taken at Lardy, near Fontainebleau (Paris). The second generation of Angers and of Rennes seems to be transitional between those two races.

(iii) *MELITAEA PARTHENOIDES* Keferstein race *SPHINES* Frühstorfer.

Pl. 7, figs. 181 ♂, 182 ♀.

Melitaea parthenie sphines Frühstorfer, 1917, *Arch. Naturges.* **82** (A) (2): 12.

This race, which can be regarded as the southern race of dry localities, was described by Frühstorfer from specimens taken in the neighbourhood of Geneva (type from Gex in June), Salève, Tramelan, and Pralognan (Savoy). It is decidedly smaller than race *communis* Verity. The wings are, on an average, still longer and narrower; the tone of the fulvous is lighter, but brighter; the black pattern of the male is sharp in outline and dark, but usually very thin and with the inner premarginal band often partly obliterated and occasionally entirely so on fore- and hind-wing, such as is seen in many examples of *M. varia* Herrich-Schäffer but, as a rule, not in race *communis* Verity. The pattern of the female is decidedly thicker than in the latter race and the fulvous is more variegated. I possess examples of this race taken in the Cevennes and in the Charente. These examples are quite similar to those from Geneva, thus showing that this is a widespread southern race. There is no detectable difference between the two generations.

(iv) *MELITAEA PARTHENOIDES* Keferstein race *BEATA* Caradja.

Pl. 7, figs. 183 ♂, 184 ♀; form *austera* Verity pl. 7, figs. 185 ♀, 186 ♂; Genitalia pl. 14, fig. 333 (same example as that illustrated on fig. 186).

Melitaea parthenie Borkhausen var. *beata* Caradja, 1894, *Deuts. ent. Z.* "*Iris*" **6** : 181.

This race was described from " the valleys of the Pyrenees, near Bagnères de Luchon, 622 m., Sost, St. Béat, 520 m." as being " of very large size and usually of a light colour." It, apparently, is the race of damp localities in the south. I possess series agreeing with it from the following localities : St. Come, near Bazas (Gironde); Dombresson, 700 m. in the Jura, near Neuchâtel; and Mount Revard, above Aix in Savoy.

Frühstorfer applied this name also to the race of the Maritime Alps, but my specimens (pl. 7, fig. 179 and genitalia pl. 14, fig. 332) from St. Martin de Vésubie are like form *communis* Verity of the nominotypical race and of race *completa* Verity. The second generation of the Gironde is a perfectly characterised population of *completa* Verity very different from the first generation, and suggesting that all these forms are " somations " rather than races hereditarily distinct.

I figure (pl. 7, figs. 185–186 and genitalia pl. 14, fig. 333) a male and a female which I received with other butterflies collected in the region of Barcelona. They must apparently be referred to race *beata* Caradja, but they have an unusual look, owing to their heavy black markings. The female has quite an alpine facies, such as only some of those I have from the Jura are an approach to, but none from the Gironde resembles at all. This peculiar aspect, to which are to be added the unusually deep, reddish tone of fulvous and large size of the male, even for race *beata* Caradja, made me think they were referable to *M. athalia* (Rottemburg), until I saw the genital armature here figured. Whether these characters are individual or racial, they are entirely worth distinguishing and I name this insect **Melitaea parthenoides** Keferstein race **beata** Caradja form **austera** form n. The type is as stated, in my collection, and is labelled " Barcelona."

(v) *MELITAEA PARTHENOIDES* Keferstein race *SEMIPLENA* Verity.

Pl. 7, figs. 187 ♂, 188 ♀.

Melitaea parthenoides Keferstein race *semiplena* Verity, 1931, *Ent. Rec.* **43** : 140.

This race approaches in general character race *plena* Verity in the male; but just falls short of it by the general extent of the black pattern on both surfaces, by the premarginal streaks not being as thick and merged together and with the marginal one, and by the female never reaching the extreme degree of melanism exhibited in race *plena* Verity. It fully agrees with the latter in the shape of the wings and in the very accentuated central row of black dots on both surfaces, as well as by the reddish tinge of the fulvous. The original description was made from a series of 12th June from La Séreyrède, at 1200 m. to 1300 m. on the Mt. Aigoual in the Cevennes, which I explicitly selected as typical and from Herrich-Schäffer's figures 136 and 137 of the upper- and underside of a German example. I noted that the latter, however, was transitional to race *plena* Verity; for the underside is fully like it. In the Pyrenees a considerable percentage of individuals of race *plena* Verity are identical with race *semiplena* Verity; and it was for this reason that I cited the locality Gèdre in the Hautes-Pyrénées in my description of the latter.

(vi) *MELITAEA PARTHENOIDES* Keferstein race *PLENA* Verity.

Pl. 7, figs. 189, 191 ♂♂, 190 ♀; Genitalia pl. 14, fig. 334 (same example as that illustrated on fig. 189).

Melitaea parthenie Borkhausen race *plena* Verity, 1921, *Ent. Rec.* **33** : 213–214.

This is the most melanic of all the races of this species. In addition to the heavy black markings on the upperside, to which I have already referred, it should be noted that there is also a broad black suffusion at the base of the wings in both sexes. The most striking feature, however, is perhaps the aspect of the underside, where all the pattern is well pronounced on the fore-wing and the usual capillary and sharp black streaks of the hind-wing are thick and shaded in outline. I described this race from specimens labelled " Gironde," but in 1931 (*Ent. Rec.* **43** : 139) I remarked that I had only seen its exact equivalent from the Puigmal in Spanish Cerdanya, above Carals. The females from the Upper Haute Garonne described by Caradja as having wings entirely suffused with black and those erroneously referred to *M. varia* Herrich-Schäffer by Rondou in his *Cat. Lep. Pyr.-Or.* for the same reason are certainly referable to race *plena* Verity. This has been fully confirmed, since; for my original specimens have been recognised from a label, by the Abbé Sorin, who had sent them to me, as not being from the Gironde, but from the Hautes-Pyrénées, collected by Rondou, from whom Sorin had received them. In fact they agree perfectly with the darkest examples of my series from Gèdre and they, no doubt, are from some locality above it.

Romei found a well-characterised population of race *plena* Verity in the Cantabrian Mts. at Puerto de Pajares, 1300 m.

(vii) *MELITAEA PARTHENOIDES* Keferstein race *VELETAENSIS* Ribbe.

Pl. 7, fig. 195 ♂; Genitalia pl. 14, fig. 335.

Melitaea parthenie Borkhausen var. *veletaensis* Ribbe, 1910, *Deuts. ent. Z.* " *Iris* " **23** : 137 (nom. nov. pro *Melitaea parthenie* Borkhausen var. *nevadensis* Spuler, 1908); *Melitaea parthenie* Borkhausen var. *nevadensis* Spuler, 1908, *Die Schmett. Europas* **1** : 25 (invalid, because a homonym of *Melitaea deione* Geyer var. *nevadensis* Oberthür, 1904).

Spuler, after giving a brief description of this race, stated that it occurred in the Sierra Nevada and in Aragon; it is clear, however, that he did not consider himself as the author of this name, for in the index to his work this name is entered as " *nevadensis* auct. ? (*parthenie*)." This race is in many respects so like *M. varia* Herrich-Schäffer that it was referred to that species until Agenjo (1934, *Eos, Madrid,* **9**) figured the genitalia and I quite independently discovered that these processes are characterised by the presence of a large uncus to the tegumen, and are perfectly characteristic of *M. parthenoides* Keferstein. The correct position of this race is therefore next to race *plena* Verity, although it possesses a highly characteristic aspect of its own.

The general appearance is normally characterised by a discoloured effect, which is particularly marked on the underside, where the russet colour is replaced by yellow of different shades. On the upperside the black pattern varies very much in the male sex; I figure an example in which the reduction of the pattern is most marked. In most females the black pattern is thin and the ground-colour yellowish and nearly white. This combination gives them a very peculiar appearance. Highly melanic females, such as are found in race *plena* Verity, do not occur in this race, although in some examples there is a broad suffusion on the basal half of the wings.

(viii) *MELITAEA PARTHENOIDES* Keferstein race *BOLIVARI* Sagarra.

Pl. 7, figs. 193 ♂, 194 ♀; Genitalia pl. 14, fig. 336.

Melitaea parthenie Borkhausen raca *bolivari* Sagarra, (1931), *Butll. Inst. catal. Hist. nat.* (2) **10** : 115.

This race was described by Sagarra from examples taken at Sant Rafel in the mountains of the Province of Segovia, *i.e.* in the Sierra Guadarrama in Old Castile. Sagarra stated that this race was the largest of the races of this species (though it is doubtful whether he was acquainted with race *beata* Caradja), that the ground-colour is a very bright fulvous colour and that the black pattern is very dark and accentuated in the male and that the female is very variegated. This extreme form I figure from topotypes. The name has been applied also to examples transitional to race *veletaensis* Ribbe, with the result that this race has been reported from the whole of the two Castiles, as far as Cuenca to the east, and up to the coast of the Bay of Biscay to the north.

Querci has made the interesting remark that he found race *veletaensis* Ribbe in exactly the same spot in the Serrania de Cuenca in the dry year 1926 where in the damp year 1928 he had found a form similar to race *bolivari* Sagarra. This is, therefore, one of the cases in which nature has indicated that it is a phenomenon of somation variation and not one of hereditary distinctness.

12. *MELITAEA ALATAUICA* Staudinger.

Pl. 7, figs. 192, 196 ♂, 197 ♀; Genitalia pl. 14, fig. 337 (same example as that illustrated on fig. 196).

Melitaea parthenie Borkhausen var. *alatauica* Staudinger, 1881, *Ent. Ztg., Stettin* **42** : 291; *Melitaea sibirica* Seitz, 1909, *Grossschmett. Erde* **1**, pl. 67, fig. B 4 ♀; *Melitaea athalia alatauica* Frühstorfer, 1919, *Arch. Naturges.* **83** (A) (3) : 179; *Melitaea athalia fruhstorferi* Wnukowsky, 1929, *Zool. Anz.* **83** : 222 (nom. nov. pro *Melitaea athalia alatauica* Frühstorfer, 1919, invalid, because a homonym of *Melitaea parthenie* Borkhausen var. *alatauica* Staudinger, 1881).

This species was described by Staudinger as a race of the species which he wrongly considered to be *M. parthenie* (Borkhausen) (*i.e.* of *M. parthenoides* Keferstein). Many years later (in 1919), Frühstorfer, who was presumably unacquainted with this insect and failed to realise that it had already been named, redescribed it as a subspecies of *M. athalia* (Rottemburg), giving it the subspecific name *alatauica* Frühstorfer. This latter name is therefore both a homonym of, and a synonym of, *alatauica* Staudinger. Ten years later (in 1929), Wnukowsky, not realising that the names *alatauica* Staudinger and *alatauica* Frühstorfer referred to the same insect, but seeing that the latter name must in any case be invalid, since it was a homonym of the former, proceeded to give the name *fruhstorferi* Wnukowsky as a nom. nov. pro *alatauica* Frühstorfer, thereby unwittingly adding a further synonym to this species.

Seitz (1909, *Grossschmett. Erde* **1** : 222) treated this insect as a race of *M. athalia* (Rottemburg); and it was not until 1913 that Suschkin raised it to the rank of a separate species, when he examined the male genital armature and found it to be extremely different from those of all the species of the genus known to him. As he was not acquainted with *M. parthenoides* Keferstein and he seemed only to have examined the aedeagus of an example of *M. varia* Herrich-Schäffer from Zermatt, his judgment with regard to the present insect might have been mistaken; and it was necessary to go into the matter further.

Fortunately I have been able to obtain a couple of specimens labelled "Kuldja, 1885," belonging to the second series received by Staudinger some four years after he first described this insect. I now figure both the genitalia and the specimens referred to above in order to make better known this insect which is so rare in collections. The genitalia agree almost exactly with the sketches given by Suschkin (1913, *Z. wiss. InsektBiol.* **9** : 324, figs. 29, 30). The insects themselves agree with the figures of the male and female given by Seitz (1909, *Grossschmett. Erde* **1** : 222, pl. 67 B). The female example figured as "*sibirica*" on the same plate is clearly also referable to this species; and it is probable that the name "*sibirica*" is a misprint for "*alatauica*," since it is not mentioned anywhere by Seitz in the text of his work and is unknown in the literature. In 1930 (*Ent. Rec.* **42** : 73) I pointed out that the genitalia of *M. alatauica* Staudinger resembled most closely those of *M. varia* Herrich-Schäffer so far as it was possible to judge by a comparison of Suschkin's illustration of the former with Reverdin's illustration of the latter. Now that I am able to examine actual preparations of the genitalia of the two species, I see that these processes in the two species do not entirely agree. The terminal apophysis of the valves in *M. alatauica* Staudinger is more like that of *M. asteria* Freyer than that of *M. varia* Herrich-Schäffer; for its fore-edge swells out into a rudimentary plateau, with a rounded, not angled (as is seen in *M. parthenie* (Borkhausen)) (= *aurelia* Nickerl), outline, and there is a row of small dents on its distal edge, whereas in *M. varia* Herrich-Schäffer there is never any swollen indentation. The similarity between the two last-named species is further enhanced by the fact that in the present species the two large terminal points are shorter and diverge so much that the fork-like look is lost and they point in almost exactly opposite directions, as they do in *M. diamina* Lang (= *dictynna* Esper). These differences may seem somewhat trifling at first sight, but the fact that they are to be observed both in Suschkin's specimen and in the one which I have examined, whereas (i) no European example of *M. varia* Herrich-Schäffer which I have seen betrays the slightest tendency to vary in that direction and (ii) variation, on the whole, is extremely small in the European insect, seems very suggestive of specific distinction. This distinction is also accompanied by a difference in the aedeagus observed by Suschkin (the absence of a stiffly chitinised sheath, with a considerable prominence downwards, at its end, as seen in *M. varia* Herrich-Schäffer and the other species of this group). It is, furthermore, accompanied by a general facies in the perfect insect, distinctly different from that of *M. varia* Herrich-Schäffer. On the other hand, the facies of *M. alatauica* Staudinger does recall the aspect of the somewhat unusual-looking race *piana* Higgins of *M. varia* Herrich-Schäffer. Higgins' original figures of the last-named in particular show a resemblance to *M. alatauica* Staudinger. The two specimens in my collection are exactly the same size, and the male has the same bright reddish fulvous tinge. The black pattern is thinner and the inner premarginal band is entirely obliterated on both fore- and hind-wing. On the underside, *M. alatauica* Staudinger is entirely different from race *piana* Higgins in that it has a central and a premarginal row of broad pure white spaces, with a distinct silvery sheen; and it has a pattern of very thick black streaks which stand out more boldly than in any example of *M. varia* Herrich-Schäffer I have seen, with the result that they recall race *plena* Verity of *M. parthenoides* Keferstein. The female is brighter and redder than in any race of *M. varia* Herrich-Schäffer with the black markings distinctly more heavy than in the male, except in the basal part of the hind-wing, where they are almost obliterated, including the inner premarginal band. The underside is exactly like that of the male instead of

being lighter as is usual in *M. varia* Herrich-Schäffer. All these characters agree fully with Staudinger's original description. Seitz figured a smaller specimen of the male sex and described it as " dull ochreous," with a faint black pattern. This is an entirely wrong description of *M. alatauica* Staudinger; Seitz also made the mistake of treating this insect as a race of *M. athalia* (Rottemburg).

M. alatauica Staudinger is only recorded from the type locality, the Ala-tau Mountains of Dzungaria. Some specimens in the Hamburgisches Zoologisches Museum are labelled " Issik-Kul " and " Dscharkent," localities which stand very far to the north of the Ferghana channel. This species belongs, therefore, entirely to the northern zone; and this sustains the hypothesis that the resemblances which I have just described may be the actual successive grades of a line of descent, from which has sprung by frigoripetal variation the entirely western, extreme psychrotropic, *M. varia* Herrich-Schäffer. This was presumably so great that three points of constitutional balance ensued and were subsequently split into three specific groups by isolation in distant mountain masses, when the temperate climate returned, after the Glacial Periods, and *M. alatauica* Staudinger and *M. varia* Herrich-Schäffer were unable to survive except near the remaining glaciers of the regions which they inhabited.

I have shown in other cases that the study of the genitalia has made it impossible to uphold any theory of this sort; but in this particular instance, which is related to the comparatively recent effects of glaciation, it is noteworthy that the variation of those organs should be in accordance with those of the general facies of the insect. It is quite conceivable that the simple, smooth point which constituted the terminal apophysis of *M. baikalensis* Bremer, 1861 (= *M. arcesia* Bremer, 1861) and that of *M. sindura* Moore, 1865 (which are shown on figs. 342 and 343 respectively on pl. 14) should have become forked into two points, as in *M. varia* Herrich-Schäffer, and also broadened out into the small plateau seen in *M. alatauica* Staudinger, by the process which has produced the very much more accentuated parallel branch seen in *M. parthenie* (Borkhausen) (= *aurelia* Nickerl). The origin of *M. parthenoides* Keferstein cannot have been the same, since it cannot have been due to the periods of glaciation, and its large uncus leaves one very much in doubt about its having derived in a direct way from a *baikalensis*-like or a *sindura*-like ancestor, which had none. I have discussed this question in connection with the other species which have an uncus and have concluded that a parallel descent is much more likely to have occurred ever since the *Phyciodes* constitutions of tropical days sustained the impact of increasingly temperate climates.

13. *MELITAEA VARIA* Herrich-Schäffer.

Melitaea varia (Bischoff MS.) Herrich-Schäffer, 1851, *Syst. Bearb. Schmett. Europ.* **6** : 2 (nom. n. pro *Melitaea athalia* Rottemburg, ? var., *id.*, 1845, *ibid.* **1** : 163, pl. 57, figs. 270 ♂, 271–274 ♀♀); *Melitaea parthenie* Herrich-Schäffer var. *varia* (Bischoff *in litt.*) Meyer-Dür, 1852, *N. Denkschr. Allgem. schweiz. Ges. Naturf.* **12** : 133, pl. 1, figs. 5 ♂, 6 [" ♂ "] ♀ (separate as *Verz. Schmett. Schweiz.*).

I have already shown, in dealing with *M. asteria* Freyer and with *M. parthenoides* Keferstein, what one can make of the position of *M. varia* Herrich-Schäffer and of the nature of its relationship with the last-named species, which is certainly very closely related, although it probably just falls within the limits of those which can and must be considered specific in the strict sense of the term. I have shown that there exist for the present no natural or artificial proofs of sterility between them but that, on the other hand, their genitalia are different

from each other to such an extent and so constantly, with no signs at all of transitional variation in either even in regions where the two exist in localities only a few miles apart, that in the present state of our knowledge one cannot come to any different conclusion.

The differences in the genital armature are the following. The tegumen in *M. varia* Herrich-Schäffer is less hardened by chitin, shorter, and shaped like a very thin crescent. It lacks the uncus entirely. The shape of the valves is ovoidal, instead of globular. The harpe bears teeth only on one-third of its length and the basal portion has none, whereas in *M. parthenoides* Keferstein it is the basal half which exhibits them. The terminal apophysis is entirely different, since instead of being triangular and ending in a single point, it ends in two large diverging ones. Neither its fore- nor its hind-edge has any trace of dents.

The differences in the general facies of the insect are not so definite. The size of *M. varia* Herrich-Schäffer is always much smaller than the average of *M. parthenoides* Keferstein; but its largest race, *piana* Higgins, is quite as large as the smallest race of the latter, such as races *sphines* Frühstorfer and *plena* Verity. The scaling is often thinner, particularly in the nominotypical race *varia* Herrich-Schäffer of the eastern Alps. The black pattern of the male is usually very thin and often partly obliterated in an irregular manner. The corresponding pattern of the female tends, on the contrary, to be much more melanic; but in *M. parthenoides* Keferstein this characteristic is equalled in race *plena* Verity. The perfectly pure white and glossy central row of spaces on the underside of the hind-wing is usually considered a characteristic of *M. varia* Herrich-Schäffer; but it is not constant in the male sex, and in race *piana* Higgins it is in fact always absent, for the white colour is replaced by yellow.

Since the real limits of this species have been exactly established by the characters of the male genitalia, it has been seen that this species is restricted to the chain of the Alps, and to the northern Jura, and to a small colony in the localities, most alpine in nature, of a few of the largest mountain masses of the Apennines in central Italy. Its geographical variations are, consequently, very few, and from those which I enumerated in 1931 (*Ent. Rec.* **43** : 151), I have already shown that race *veletaensis* Ribbe from Spain must be removed from the list because it is in fact a race of *M. parthenoides* Keferstein.

(i) *MELITAEA VARIA* Herrich-Schäffer race *PIANA* Higgins.

Pl. 7, figs. 202 ♂, 203 ♀; Genitalia pl. 14, fig. 338 (same example as that illustrated on fig. 202).

Melitaea varia piana Higgins, 1930, *Entomologist* **63** : 153, pl. 2, figs. 9 ♂, 10 ♀.

Higgins described this race from specimens taken at Limone, the Col di Tenda, and Tenda from 800 to 1300 m. It is confined to the Maritime Alps, but occurs there in certain localities only, for it is usually replaced in that region by race *variabella* Verity. I place this race before the others because in its general appearance it is less highly characteristic of the species, although its genitalia are exactly as usual. In this species they vary extremely little, either individually or locally, and are entirely characteristic. Fig. 338 on pl. 14 represents the genitalia of a specimen of race *piana* Higgins from St. Martin-de-Vésubie, from which locality I possess a magnificent series showing the numerous variations in colour and pattern of the female sex, from highly

melanic to light coloured and thinly marked forms. The most glacial form of nominotypical *varia* Herrich-Schäffer, with translucent wings and very pale colouring, is not produced in the present race; and the richer average pigmentation recalls that seen in *M. parthenoides* Keferstein, which is recalled also by the larger size, especially striking in the males, and by the pale surfaces on the underside of the hind-wings being yellowish instead of shining white. All these features, except this last mentioned, constitute also an approach to *M. alatauica* Staudinger, thus suggesting that race *piana* Higgins has the least psychrotropic constitution found in the races of *M. varia* Herrich-Schäffer and that this race is the one least different from the form which came over from Asia and was transformed into the more extreme *M. varia* Herrich-Schäffer by glacial conditions when widespread in Europe. As a matter of fact, race *piana* Higgins inhabits to-day the least glacial of the regions and localities in which any race of *M. varia* Herrich-Schäffer now occurs.

(ii) *MELITAEA VARIA* Herrich-Schäffer race *GILBON* Frühstorfer.

Pl. 9, figs. 252 ♂, 253 ♀; Genitalia pl. 14, fig. 339 (same example as that illustrated on fig. 252).

Melitaea parthenie gilbon Frühstorfer, 1917, *Arch. Naturg.* **82** (A) (2) : 12.

This race was described by Frühstorfer from examples taken in June at Neuveville in the Jura. These specimens are now in the Paris Museum. In his original description Frühstorfer gave also as additional localities the Bernese Oberland and the Canton Berne; but there are no specimens from these localities in the series now in the Paris Museum. I should add that some specimens taken at Belpmoos near Berne proved, on my examining the male genitalia, to be referable not to this species but to *M. parthenoides* Keferstein.

Frühstorfer treated this insect as a race of what he considered was *M. parthenie* (Borkhausen) (*i.e.* a race of *M. parthenoides* Keferstein); and placed it after race *sphines* Frühstorfer, saying that it represented " a further transition which connects the specimens of southern Germany with *varia* M.-D. [*i.e. varia* Herrich-Schäffer] of the high alps." He, of course, had no knowledge of the evidence which the male genitalia provides to show that *M. parthenoides* Keferstein and *M. varia* Herrich-Schäffer are specifically distinct from one another. Thus his judgment was based simply on a deduction drawn by rule of thumb from the general appearance of the two insects. I have dissected the male genitalia of Frühstorfer's type, and have in this way established that this race is in fact referable to *M. varia* Herrich-Schäffer and not to *M. parthenoides* Keferstein.

It may be seen, therefore, that *M. varia* Herrich-Schäffer ranges as far north as the northern Jura. No doubt it occurs also in the high mountains of the intervening Bernese Oberland, though at lower elevations in that region there occur races of *M. parthenoides* Keferstein, which do not betray the slightest signs of being transitional to *M. varia* Herrich-Schäffer.

The position of race *gilbon* Frühstorfer from Neuveville is now seen to be next to the races from the western Alps dealt with immediately below. Comparing race *gilbon* Frühstorfer with nominotypical race *varia* Herrich-Schäffer from the eastern Alps, one may say that it stands one grade further from that race than does race *variabella* Verity, and that it resembles race *piana* Higgins very much in size and general facies and also by reason of the variegated colouring of the female. It differs from that race distinctly on account of the ground-

colour of the underside in the male, which exhibits very prominent white and silvery spaces.

(iii) *MELITAEA VARIA* Herrich-Schäffer race *VARIABELLA* Verity.

Pl. 7, figs. 200 ♂, 201 ♀.

***Melitaea varia* Meyer-Dür race *variabella* Verity, 1931, *Ent. Rec.* 43 : 152.**

This race, like race *piana* Higgins, inhabits the Maritime Alps; but the two races occur in different localities. As a rule, the present race (as observed by Higgins at Limone, 1700 m.) occurs in the higher localities, and race *piana* Higgins in the lower ones. From the Maritime Alps race *variabella* Verity extends all over the western Alps as far east as the Simplon. The latter is the most easterly locality in which this race is known to occur, and is very probably in fact the locality at the extreme eastern end of its area of distribution; for already in the Valais at such localities as Zermatt and the Simplon Kulm, 2200 m., the race which occurs is the nominotypical race *varia* Herrich-Schäffer, the specimens found there being quite indistinguishable from those of the eastern Alps.

Race *variabella* Verity has a decidedly different aspect from that of race *varia* Herrich-Schäffer. It is larger, less frail, and more brilliantly coloured, especially in the female sex, which varies in the same remarkable manner observed in race *piana* Higgins. It differs from the last-named race by its much smaller size, by the somewhat narrower and more elongated shape of the wings, and by the presence of the silvery-white spaces seen in nominotypical *varia* Herrich-Schäffer. It is, therefore, intermediate between these two races, and at each end of its area of distribution it is transitional to the next-adjoining race.

The types of this race are specimens taken at Clavières, 1800 m., in the Cottian Alps. Among the paratypes there are also specimens taken in the Vallasco, 1700 m., in the Maritime Alps, and others taken in the mountains above Ventimiglia.

(iv) *MELITAEA VARIA* Herrich-Schäffer race *VARIA* Herrich-Schäffer.

Pl. 7, figs. 198 ♂, 199 ♀; Genitalia pl. 14, fig. 340 (same example as that illustrated on fig. 198).

The name *varia* is universally attributed to Meyer-Dür, but in fact that author expressly stated that it was Bischoff who had first proposed this name *in litt.* Further, it should be observed that, contrary to the commonly accepted view, Meyer-Dür was not the first author to publish this manuscript name of Bischoff's; for one year earlier (*i.e.* in 1851) Herrich-Schäffer had published this name, which he also attributed to Bischoff *in MS.*, and which he validated by applying it expressly to the insect figured by him in 1845 as a doubtful variety of *M. athalia* (Rottemburg) on pl. 57 of his great work (figs. 270 ♂, 271–274 ♀♀). Herrich-Schäffer himself gave the locality "Wallis aus Anderregg," and Meyer-Dür gave the locality "eastern Bündtner Alps, quite near the middle of the glacier region, at 6000 or 7000 ft." The locality given by Herrich-Schäffer should be taken as the type-locality of this species. Similarly, Herrich-Schäffer's figure 270 should be taken for the male holotype, and his figures 271–272 for the female allotype of nominotypical *varia* Herrich-Schäffer. The second female figured by Herrich-Schäffer (figs. 273, 274) falls more within

the limits of the preceding race (race *variabella* Verity), as I have already pointed out elsewhere (1935, *Ent. Rec.* **47** *Suppl.* : (73)). Further, it should be noted that the male and female which I must now recognise as the holotype and allotype of nominotypical *varia* Herrich-Schäffer (figs. 270–272) do not belong to the most highly characterised, frail and dark, form of the eastern race of the species; but I possess specimens quite similar to them, taken in the Engadine at Sass da Muottas.

This race spreads eastwards from the Canton Grisons to the Tyrol and the Alto Adige, while westwards it occurs (as explained above under race *variabella* Verity) as far as Zermatt in the Upper Valais.

Race *varia* Herrich-Schäffer is the most extreme glacial representative of the species. It is of very small size, and is frail and thinly scaled, so much so indeed that some females are quite translucent. The black pattern of the male is very thin, and in part obliterated. Most of the females have the greater part of the wings on the upperside dusted more or less thickly with grey or black scales, and they often exhibit a distinct greenish sheen. On the underside of the hind-wings, the central white space, or row of spaces, is of a perfectly pure tone and is glossy in appearance.

(v) *MELITAEA VARIA* Herrich-Schäffer race *VARISSIMA* Verity.

Genitalia pl. 14, fig. 341.

Melitaea varia Meyer-Dür var. *varissima* Verity, 1914, *Bull. Soc. ent. ital.* **45** : 210–212.

This race occurs at very great elevations (1200 to 1800 m.) in a few of the most alpine of the mountain massifs of central Italy. The types were taken on the Piano Astore near Bolognola in the Sibillini Mountains in the Marche. It occurs also on the Gran Sasso in the Abruzzi.

Race *varissima* Verity stands nearest to race *variabella* Verity; but it differs from that race by its lighter colouring in both sexes and on both surfaces of the wings, with the result that it has a less rich appearance. On the underside, however, the russet markings are more extensive than in race *variabella* Verity, and have a much clearer and brighter red tone. The black pattern is normally thinner, and this is particularly striking on the upperside in the male. Some females are quite as variegated as the Alpine ones, both as regards the tone of the fulvous and as regards the black pattern. In some examples, the basal suffusion invades the greater part of the wing-surface.

The genitalia of race *varissima* Verity are identical with those of nominotypical *varia* Herrich-Schäffer.

ON THE STATUS OF *MELITAEA SULTANENSIS* STAUDINGER, 1886

By Roger Verity, M.D., F.R.E.S.

I exclude *M. sultanensis* Staudinger (*Melitaea parthenie* Borkhausen var. *sultanensis* Staudinger, 1886, *Ent. Ztg, Stettin* **47**: 234) from the *athalia* group of the genus *Melitaea* Fabricius, notwithstanding the fact that (as shown above) it was originally described as a variety of *M. parthenie* (Borkhausen) as then understood, *i.e.* as a variety of *M. parthenoides* Keferstein. Seitz (1909, *Grossschmett. Erde* **1**: 223) still accepted this relationship, although Staudinger eight years earlier (1901, *Cat. Lep. pal. Faunengeb.* : 31) had treated this as a distinct species, placing it between *M. romanovi* Grum-Grshimailo (1891, *Hor. Soc. ent. ross.* **25**: 454) and *M. deione* (Geyer). That position also is clearly incorrect. The general facies of this insect suggests a close relationship with *M. minerva* Staudinger (1881, *Ent. Ztg, Stettin* **42**: 289–291); and the male genital armature, which I have examined, definitely confirms the closeness of this relationship.

ON *MELITAEA AURELIA* NICKERL VAR. *PSEUDO-RHAETICA* KIEFER, 1918

By Francis Hemming, C.M.G., C.B.E.

While the present paper was passing through the press, I drew Dr. Verity's attention to the fact no reference was made therein to *Melitaea aurelia* Nickerl var. *pseudo-rhaetica* Kiefer, 1918 (*Z. österr. ent. Ver.* **3** : 109, figs. 1–12). Dr. Verity, who was not in a position to examine the original description and figures, asked me to do so, and, if possible, to clear up the systematic position of this insect. The outbreak of war with Italy has made it impossible for me to communicate to Dr. Verity the results of my examination of this subject, and to obtain his agreement as to the place to be allotted to this insect. For the moment, therefore, its status must be left indeterminate, but I give the following short note on this insect for the sake of completeness :—

Kiefer stated that a small form of *Melitaea aurelia* Nickerl (= *M. parthenie* (Borkhausen)) occurred in June on the moors in the Admont region. This form had been taken by himself on the Kainisch-Moor near Aussee and by Dr. R. von Mack near Gröbming. This form, Kiefer stated, was identical with that which Hoffmann (*Schmett. Steiermarks* **1** : 239) had taken for *M. parthenie varia* Meyer-Dür [*i.e. M. varia* Herrich-Schäffer]. Kiefer gave the measurements of the series collected by Dr. von Mack and himself as follows :—fore-wing length, 13–14 mm. in the male and 16 mm. in the female. He added that he had sent several specimens of this insect to Herr Klos at Kroisbach and that he had consulted also Professor Rebel of Vienna on the question whether this insect should be given the name *pseudo-rhaetica*. Dr. Rebel had taken the view, however, that this insect was identical with race *rhaetica* Frey. Kiefer appears then to have dropped his idea of naming this insect but his action in mentioning this name, when referring to this correspondence in his published paper, combined with the description and figures which he gave, constitute a valid publication of the *pseudo-rhaetica* Kiefer.

ON *MELITAEA PARTHENIE* BORKHAUSEN [AB. UND VAR. *JORDISI* RÜHL, 1893

By Francis Hemming, C.M.G., C.B.E.

In the course of editing the present paper, I drew Dr. Verity's attention to the fact that he had made no reference to *Melitaea parthenie* Borkhausen ab. und var. *jordisi* Rühl, 1893 (*Soc. ent.* **7** (21) : 164). Dr. Verity replied that this was intentional, since he regarded *jordisi* Rühl as an aberration only. The outbreak of war made it impossible for me to continue my correspondence with Dr. Verity on this case. It is sufficient here to say that in principle it is similar to that of the name *Melitaea athalia* Rottemburg form *rhodoleuca* Stauder, 1914, which I discuss in the immediately following note. It should be observed, however, that, whereas Stauder used the indeterminate term " form " when describing *rhodoleuca* Stauder, Rühl stated expressly that *jordisi* Rühl was both " ab. und var.," *i.e.* that the name was applicable both to an aberration and to what would now be called a subspecies or race. In this case, therefore, the original author himself, in putting forward *jordisi* Rühl as a new name, made it clear that it was intended to apply to a form which in some places was racial but not in others. To ignore the name *jordisi* Rühl in a discussion of the racial variation of the species concerned would be not only to contravene the provisions of the International Code (as I explain in the immediately following note) but also completely to ignore the intention of the original author of the name.

Rühl, like all authors of his day and for many years afterwards, misidentified *M. parthenie* (Borkhausen) with the species of which, as we now know, the correct name is *M. parthenoides* Keferstein. It is, therefore, to the latter species that the name *jordisi* Rühl should either be applied as a racial name or be sunk as a synonym of some earlier name. In point of fact, the name *jordisi* Rühl has priority over all the racial names applied to this species with the exception of the specific name *parthenoides* Keferstein itself. Rühl stated that this insect was taken at Frankfurt at the beginning of August. All that is required is to establish the identity of the race occurring in that locality. The probability is that it will be found to be a race either identical with, or close to, nomino-typical *parthenoides* Keferstein or to race *completa* Verity. If it proves to be identical with race *parthenoides* Keferstein, the name *jordisi* Rühl will fall as a synonym; while, if it proves to be identical with *completa* Verity, it will replace that name.

ON THE AVAILABILITY AS SPECIFIC AND SUBSPECIFIC NAMES (*a*) OF NAMES GIVEN TO EXAMPLES EXHIBITING ABERRANT CHARACTERS and (*b*) OF NAMES TREATED AS FORMS OR ABERRATIONS BY THEIR ORIGINAL AUTHORS

By Francis Hemming, C.M.G., C.B.E.

1. On the outbreak of war with Italy, I was still in correspondence with Dr. Verity in regard to the following case, which raised an important issue of principle on two closely allied subjects, namely :—

(i) Is a name available under the International Code as a specific or subspecific name if the example on which it is based (*i.e.* the type) exhibits aberrant characters?

(ii) Is a name available under the International Code as a specific or subspecific name if its original author treated it not as the name of a new species or subspecies but as the name of a form of lower status than that of a subspecies, *i.e.* as the name of a "form" or "aberration"?

This question arose in connection with the name to be applied to the race of exerge *helvetica* Rühl of *M. athalia* (Rottemburg) found at S. Fili on the Calabrian Coast range, which is dealt with on p. 617 of Dr. Verity's paper.

2. The position as regards this race is as follows :—

(*a*) in 1914 Stauder gave the name *Melitaea athalia* Rottemburg form *rhodoleuca* (*Z. wiss. InsektBiol.* **10** : 374) to an aberrant example of this, then unnamed, race, taken at S. Fili;

(*b*) in 1921, Verity gave the name *Melitaea athalia* Rottemburg race *obscura-maxima* Verity (*Ent. Rec.* **33** : 213) to this race. Verity's type also was taken at S. Fili.

3. In his original manuscript, Dr. Verity applied the name *obscura-maxima* Verity to this race and made no mention of the earlier name *rhodoleuca* Stauder. Thinking that this was an oversight on his part, I suggested to Dr. Verity that the proper course would be to apply to this race the name *rhodoleuca* Stauder, since it had seven years' priority over the name *obscura-maxima* Verity. The following is an extract from a letter (dated 27th April, 1940) which I subsequently wrote to Dr. Verity on this subject :—

"I note that you have suggested that the name *obscura-maxima* Verity should be used in place of the name *rhodoleuca* Stauder in spite of the fact that the latter has seven years' priority. I gather that you make this sugges-

tion in view of the fact that the insect so named by Stauder was an aberration although in fact it was described by him as a 'form,' a term used by you in the past and by many other authors in describing racial and specific entities. You are mistaken in supposing that this course is permissible under the Code. The name for species or races is the first published name for an individual of that species or race. It is a matter of complete irrelevance whether or not the individual to which the first name was given was a representative example of that species or race, or whether, on the contrary, it was an aberrant individual. There are many cases in which races, and a number of cases also in which actual species, are based upon individuals subsequently found to be aberrations only. Similarly, it is entirely irrelevant whether the original author of a given name regarded the insect to which he applied that name as a species or as a race or as a form or as an aberration. The only fact which is of importance is the identity of the insect to which the name was given. It is for later authors in the light of all information available to determine the status of the insect to which the name was applied. A good example of this particular class of case is provided by the name *berisalii* Rühl, which, as we know, is one of the most highly specialised races of *M. deione* (Geyer). The name is quite correctly used in this sense, although Rühl himself in describing this insect, described it as a new 'aberration.' For these reasons I feel bound to reinstate the name *rhodoleuca* Stauder for the race from S. Fili."

4. On 9th May Dr. Verity replied as follows :—

"I cannot agree to the principle of applying to the racial features, the name which was, by pure chance, given to accidental characters of one individual from the locality of the race, such as has happened in the case of *rhodoleuca* Stauder. The name of the aberrant features must remain free, to be applicable to similar aberrations in all the races of that species and even genus. The aberrant features of that female [*i.e.*, of Stauder's type] have nothing to do with Calabria, like those of *obscura-maxima* have.

"Let me add that, by following your principle, *Melitaea athalia helvetica* Rühl should be called *cymothoë* Bertoloni, because the latter described (1829, *Ann. Stor. nat. Bologna* **2**: 237) a black aberration of it from Spezia (Eastern Liguria), near the boundary of Tuscany : it is the name which should be used instead of ab. *navarina* Selys, as it was published in 1829, whereas Selys's is of 1837. Ab. *rhodoleuca* Stauder stands in the same position, so, please, on no account, reinstate it for the race."

5. This was the state of our correspondence when (as already explained) it was abruptly cut short by the outbreak of war. I was therefore faced with the choice, as editor of this paper, of passing for publication the use of what I must regard as a synonym in place of an older valid name (as proposed by Dr. Verity) or of transposing the use of these names, notwithstanding the objections of the author of the paper. I have decided to adopt the latter course, but I have inserted the present note in order to show exactly what is the position of Dr. Verity in this matter and why I have felt bound to differ from him.

CONCLUDING NOTE

By Francis Hemming, C.M.G., C.B.E.

1. To avoid any possibility of misunderstanding in the future, I think it well to place on record that, prior to the entry of Italy into the war and the consequent cessation of all communication between that country and the United

Kingdom, Dr. Verity had seen and passed for publication the galley proofs of the whole of his paper, *i.e.* the whole of the portion up to, and including, his concluding note (on p. 689) on the status of *Melitaea sultanensis* Staudinger, 1886. Apart from the changes in the concluding sentences in the passage (on p. 617) relating to *Melitaea athalia rhodoleuca* Stauder necessary to draw attention to his disagreement with my views and to refer to my subsequent note on the subject, the only passages in which any but purely verbal changes have been made since the return of the corrected proofs by Dr. Verity, are those dealing with the following :—

(i) *M. athalia lachares* Frühstorfer (p. 640), where I have inserted an introductory paragraph showing that *M. athalia borealis* Lindstrom is a synonym;

(ii) *M. parthenie parthenie* (Borkhausen) (pp. 663, 668), where I have added to words explaining that *M. aurelia serotina* Oberthür is a synonym;

(iii) *M. parthenie nigrobscura* Verity (p. 666) and *M. parthenie aurelia-nigrobscura* Verity (p. 667), where I have added words to bring out more clearly the nature of the differences explained by Dr. Verity in his original descriptions of these races;

(iv) *M. parthenie imitatrix* Verity (p. 671), where I have explained that *M. britomartis segusiana* Rocci is a synonym;

(v) *M. alatauica* Staudinger (p. 683), where I have completed the synonymy and have added an introductory paragraph explaining the status of *M. athalia alatauica* Frühstorfer, 1919, and *M. athalia fruhstorferi* Wnukowsky, 1929.

Of these minor changes, (i) is the result of Dr. Verity's request that I should examine the status of *M. athalia borealis* Lindstrom; (iii) appeared to me necessary for the sake of clarity; (ii), (iv), and (v) were the result of agreement reached between Dr. Verity and myself in correspondence.

2. For the list of new names introduced in Dr. Verity's paper, for the Check-List of species and subspecies, and for the alphabetical index, I alone am responsible. Dr. Verity furnished the materials for the explanations of the plates, but responsibility for the lay-out adopted rests with myself.

3. I should like to take this opportunity of thanking Signorina Georgia Valensin, Miss E. Stansfeld, and Miss B. Bishop for the great help which they have given me either in checking bibliographical references or more generally in preparing the manuscript of Dr. Verity's paper for the printer and in helping me to see it through the press.

4. It has given me great pleasure to work with Dr. Verity during the final stages of the preparation of this paper, which not only contains a mass of important new data but also brings together in a compact and systematic form all the conclusions which he has reached during the last twenty years, and which, till now, have only been accessible in a large number of short papers published in various European entomological journals. Some workers may hesitate to accept all Dr. Verity's conclusions, but all will agree that his present paper marks an important new stage in the study of this difficult group of butterflies.

List of New Names Introduced in the Present Paper.

PAGE

Melitaea ambigua Ménétriés race *niphona* Butler form *crassepicta* form n. . . 600

Melitaea ambigua Ménétriés race *sayanskalpina* race n. 600

Melitaea athalia Rottemburg exerge *helvetica* Rühl *uncummimans* ab. n. . . . 612

Melitaea athalia Rottemburg race *asiae* race n. 612

Melitaea athalia Rottemburg race *asiae* Verity form *asiaefrigida* form. n. . . 613

Melitaea athalia Rottemburg race *luciflua* Frühstorfer Gen. II *postluciflua* form. n. . 620

Melitaea athalia Rottemburg race *subluciflua* Verity Gen. II *postsubluciflua* form. n. . 620

Melitaea athalia Rottemburg race *melida* Frühstorfer Gen. II *postmelida* form. n. . 622

Melitaea athalia Rottemburg race *melangraphata* Beuret *postmelangraphata* form. n. . 622

Melitaea athalia Rottemburg race *mixtaceladussa* race n. 625

Melitaea athalia Rottemburg race *mixtalpicola* race n. 626

Melitaea athalia Rottemburg race *delminia* Frühstorfer form *pseudodelminia* form. n. 627

Melitaea athalia Rottemburg race *benacensis* race n. 627

Melitaea athalia Rottemburg race *microdelminia* race n. 628

Melitaea athalia Rottemburg race *orientalpicola* race n. 633

Melitaea athalia Rottemburg race *diaminoides* nom. nov. pro *Melitaea athalia dictynnoides* Frühstorfer, 1917 635

Melitaea athalia Rottemburg race *parvanigra* race n. 644

Melitaea athalia Rottemburg race *parvahispanica* race n. 646

Melitaea britomartis Assmann race *frigidaltaica* race n. 657

Melitaea parthenoides Keferstein race *beata* Caradja form *austera* form. n. . . 681

Check List of the Species of the *athalia* Group of the Genus *Melitaea* Fabricius, 1807.

Name.	Type Locality.	Page at which Discussed in Present Paper.
1. *Melitaea pacifica* Verity, 1932 (= *plotina* Bremer, auct. *nec* Bremer).		594–595
(i) race *pacifica* Verity, 1932.	Troiz Kossowsk, 800 m., Province of Transbaikal.	595
(ii) race *ussuriae* Verity, 1932.	Sutshansky Rudnik, near Vladivostok.	595
2. *Melitaea ambigua* Ménétriés, 1859.		596–600
(i) race *niphona* Butler, 1878.	Tokyo, Japan.	598
(ii) race (?) *nossis* Frühstorfer, 1919.	Nagasaki.	598
(iii) race *sachalinensis* Matsumura, 1925.	Rikovskoie, Sakhalin Island.	598
(iv) race *ambigua* Ménétriés, 1859.	Amur, Djai.	599
(v) race *kenteana* Seitz, 1909.	Kentei.	599
(vi) race *sayanskalpina* Verity, 1940.	Eastern Sayansk Mountains, south of Lake Baikal, Chulugaisha, 2600 m. above Mondy.	600
3. *Melitaea deione* (Geyer) [1828]–[1832].		601–605
(i) race *rosinae* Rebel, 1911.	Portugal, Cintra near Lisbon.	601
(ii) race (?) *philomela* Frühstorfer, 1919.	Portugal.	602
(iii) race *nitida* Oberthür, 1909.	Algeria, Sebdou, Oranie, Andalusia.	602
(iv) race (?) *espunaensis* Korb, 1915.	Sierra d'Espuna, Province of Murcia.	603
(v) race *deione* (Geyer) [1828]–[1832].	Aix-en-Provence (*teste* Duponchel).	603
(vi) race *vesubiana* Verity, 1932.	St. Martin-de-Vésubie, Alpes-Maritimes.	603
(vii) race *phaisana* Frühstorfer, 1917.	Clausen, South Tyrol (Alto Adige).	604
(viii) race *tessinorum* Frühstorfer, 1918.	Biasca, Ticino.	604
(ix) race *signata* Sagarra, 1926.	Seva and Montseny, N. Catalonia.	604
(x) race *rondoui* Oberthür, 1909.	Gèdre, Hautes-Pyrénées.	605
(xi) race *berisalii* Rühl, 1891.	Martigny, Valais (*falsè* Berisal).	605
4. *Melitaea athalia* (Rottemburg).		605–646
Section I. Exerge *helvetica* Rühl (=*pseudathalia* Reverdin).		610–624
(*a*) Group of races of exerge *helvetica* Rühl in which the male genital armature is characterised by the absence of the uncus.		612–618
(i) race *asiae* Verity, 1940.	Mining district of Sutshansky, coast region.	612
(ii) race *iberanana* Verity, 1930.	Central Portugal, Serra de Estrela (800–1000 m.).	613

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(iv) race *hispanica* Wnukowsky, 1929. (syn. :—*iberica* Staudinger, 1901.)	Central Spain and Northern Portugal (*Staudinger*, 1901).	614
(v) race *aranensis* Sagarra (1931).	Salardù als Banys de Tredòs (Aran), Pyrenees and Aragon.	614
(vi) race *deioneformis* Verity, 1914.	Central Italy.	615
(vii) race *tenuis* Verity, 1919.	Pian di Mugnone near Florence.	616
(viii) race *tenuicula* Verity, 1919.	Sibillini Mountains, Bolognola (Piano Astore).	616
(ix) race *submaxima* Verity, 1924.	Forte dei Marmi, Northern Tuscany.	617
(x) race *maxima* Turati, 1911.	Paola (sea level), Calabria.	617
(xi) race *rhodoleuca* Stauder, 1914. (syn. :—*obscura-maxima* Verity, 1921.)	S. Fili, Coast ranges of Calabria.	617
(xii) race *obscura* Verity, 1919.	Altipiani di Carmelia (1200 m.) on the Aspromonte in Calabria.	617
(xiii) race *sicula* Turati, 1915.	Ficuzza, Province of Palermo.	617
(*b*) Group of races of exerge *helvetica* Rühl in which the male genital armature is characterised by the presence of a rudimentary uncus (two knobs, with or without tiny spikes, set broadly apart from one another).		618–624
(xiv) race *divergens* Rocci, 1930.	Lombardy on the borders of Piedmont, along the Ticino from the line Turbigo-Galliate to Santa Maria del Bosco.	618
(xv) race *hastensis* Rocci, 1932.	Monferrato, Southern Piedmont.	619
(xvi) race *celadussa* Frühstorfer, 1910.	Col di Tenda, Maritime Alps.	620
(xvii) race *luciflua* Frühstorfer, 1917.	Petit Salève, near Geneva.	620
(xviii) race *subluciflua* Verity, 1935.	Martigny, Lower Valais.	620
(xix) race *veragrorum* Verity, 1935.	Upper Rhone Valley, between Bex and the Lake of Geneva (damp meadows).	621
(xx) race *subhelvetica* Verity, 1935.	Loetschenthal, Wyler-Ried, Ried Fasleralp and Platten.	621
(xxi) race *melida* Frühstorfer, 1919.	Maroggia and the slopes of the Monte Generoso in the Tessin up to an elevation of about 1200 m.	621
(xxii) race *melangraphata* Beuret, 1932.	Valleys and mountains of the Tessin :—Canaria Valley (type), Fusio.	622

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(xxiii) race *helvetica* Rühl, 1888.	Grisons; Stalla and Bergün.	623
(xxiv) race *noctula* Frühstorfer, 1919.	Canton Glarus :—Erstfeld Valley (type), Glärnisch, 1400–1800 m.	623
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(xxv) race *mixtaceladussa* Verity, 1940.	Gèdre, Hautes-Pyrénées.	625
(xxvi) race *pseudathalia* Reverdin, 1920.	Bernese Jura, Tramelan.	625
(xxvii) race *synexergica* Verity, 1930.	Soleure Canton; and in the Jura near frontier of Bâle-Campagne Canton.	626
(xxviii) race *mixtalpicola* Verity, 1940.	Grisons :—Pontresina.	626
(xxix) race *delminia* Frühstorfer, 1910.	Meran, South Tyrol.	627
(xxx) race *benacensis* Verity, 1940.	Mount Baldo, east side of Lake Garda.	627
(xxxi) race *microdelminia* Verity, 1940.	Mendola Pass, 1500 m.	628
(xxxii) race *vividior* Gouin, 1922.	Gironde :—Sauros and Bazadars.	628
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(*a*) Group of races of exerge *athalia* (Rottemburg) in which the male genital armature is characterised by the presence of a slender uncus.		
(xxxiii) race *anatolica* Wagner, 1929.	Inner Anatolia, Sultan-Dagh, 1500 m.	631
(xxxiv) race *dejonides* Wagner, 1918.	Rumania :—Pd. Barac, near Hatcaran, Prahova district.	632
(xxxv) race *fiorii* Rocci, 1932.	Palmanova, Province of Udine.	632
(xxxvi) race *orientalpicola* Verity, 1940.	Sappada, 1400 m., Carnic Alps.	633
(xxxvii) race *pseudodictynna* Stauder, 1922.	Hallstaetter in Salzkammergut.	633
(xxxviii) race *suessula* Frühstorfer, 1917.	Upper Bavaria :—Rohrseemoos am Kochelsee.	634
(xxxix) race *parthenoidemima* Verity, 1940.	Western Bulgaria, Rilo Dagh, Kyrilowa Pal (1500 m.).	634
(xl) race *limera* Frühstorfer, 1917.	Bosnia, Koricna.	635
(xli) race *diaminoides* Verity, 1940. (syn. :—*dictynnoides* Frühstorfer, 1917.)	Transylvania, the Bukowina, part of Herzegovina, Galicia.	635
(xlii) race *lucifuga* Frühstorfer, 1917.	Saratoff, Lower Volga.	636
(xliii) race *caucasogenita* Verity, 1930.	Caucasus (*Heyne*).	636
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(1) Sub-group in which the male genital armature is characterised by the presence of a comparatively long uncus.		638–644

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(xliv) race *tinica* Frühstorfer, 1910.	Irkutsk.	639
(xlv) race *norwegica* Aurivillius.	Central Norway.	639
(xlvi) race *lachares* Frühstorfer, 1919.	Sweden :—neighbourhood of Stockholm.	640
(xlvii) race *scardona* Frühstorfer, 1910.	Croatia :—Agram (*i.e.* Zagreb).	641
(xlviii) race *mehadiensis* Gerhard, 1882.	Mehadia, southern Hungary near Rumanian frontier.	642
(xlix) race *boris* Frühstorfer, 1917.	Bulgaria, Rhodope mountains.	643
(l) race *athalia* (Rottemburg), 1775.	Paris.	643
(li) race *parvanigra* Verity, 1940.	Byvank, Holland.	644
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(lii) race *britanna* Verity, 1914.	England :—Tavistock, South Devon.	645
(liii) race *parvahispanica* Verity, 1940.	Old Castile, Segovia and San Ildefonso; Aragon, Zaragoza, Veruela.	646
5. *Melitaea coreae* Verity, 1930 (? = race of *M. mayi* Gunder, 1929).	Corea.	646
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7. *Melitaea britomartis* Assmann, 1847.		649–663
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(i) race *centralasiae* Wnukowsky, 1929. (syn. :—*mongolica* Staudinger, 1892.)	Kentei (*Staudinger*).	653
(ii) race *seminigra* Seitz, 1909.	Sajan.	654
(iii) race *menetriesi* Caradja, 1895.	Amurland, Bouri.	654
(iv) race *septentriorientis* Verity, 1930.	Kamchatka.	654
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(v) race *frigidaltaica* Verity, 1940.	Altai centr. mont.	656
(vi) race *amurensis* Staudinger, 1892.	Amur, Raddejewska.	657
(vii) race *plotina* Bremer, 1861.	Bureja Mountains.	658
(viii) race *imitans* Verity, 1930.	Transbaikalia Province, Tchita (between the Kentei Mountains and the Amur).	659
(ix) race *marussia* Frühstorfer, 1919.	Saratoff, Lower Volga.	659
(x) race *britomartis* Assmann, 1847.	Klarenkranst, three miles east of Breslau.	660
(xi) race *dictynnoides* Hormuzaki, 1898.	Bukowina, Czernowitz.	660
(xii) race *aureliaeformis* Verity, 1917.	Venaria (neighbourhood of Turin).	661
(xiii) race *melathalia* Rocci, 1930.	Lombardy, Turbigo (between Milan and Lake Maggiore).	663

Name.	Type Locality.	Page at which Discussed in Present Paper.
8. *Melitaea parthenie* (Borkhausen), 1788 (commonly but erroneously known as *M. aurelia* Nickerl).		663–673
(i) race *nigrobscura* Verity, 1931.	Herrsching in southern Bavaria.	666
(ii) race *valsunga* Frühstorfer, 1919.	Upper Bavaria, Barmsee.	667
(iii) race *micromelanica* Verity, 1935.	Valais, Pfynwald.	667
(iv) race *aurelia-nigrobscura* Verity, 1931.	Vienna.	667
(v) race *vividocolore* Verity, 1931.	Kisnyir, Hungary.	668
(vi) race *aurelia* Nickerl, 1850.	Bohemia.	668
(vii) race *parthenie* (Borkhausen), 1788.	Erlangen, in Franconia.	668
(viii) race (or races) occurring in the U.S.S.R.	Moscow, and Southern Ural Mts.	668
(ix) race *rhaetica* Frey, 1880.	Canton Grisons, Chur, 700 m.	669
(x) race *poenina* Verity, 1931.	Bérisal, Upper Valais.	669
(xi) race *carsicola* Verity, 1932.	Opcina, table-land of the Carso, 300 m., near Trieste.	670
(xii) race *mussinae* Costantini, 1916.	Prov. Reggio Emilia, La Mussina, near Borzano.	670
(xiii) race *luceria* Frühstorfer, 1917.	Cogne, Aosta Valley.	670
(xiv) race *imitatrix* Verity, 1932.	Oulx, 1100 m., Susa Valley.	671
(xv) race *verbanica* Rocci, 1932.	Valtravaglia, 700–900 m., Lombard side of Lake Maggiore.	671
(xvi) race *mendrisiota* Frühstorfer, 1919.	Canton Tessin, Mt. Generoso, south of Lugano, 600 m.	672
(xvii) race *ligustica* Rocci, 1932.	Val Bisagno, 600–700 m., Ligurian Apennines.	672
9. *Melitaea veronicae* Dorfmeister, 1853.	Styria, Bruck a. d. Mur.	673
10. *Melitaea asteria* Freyer, 1828.		673–677
(i) race *rebeli* Wnukowsky, 1929.	Tschuja Mts., 2100–2400 m., massif of the Altai.	676
(ii) race *asteria* Freyer, 1828.	Canton Grisons, Chur.	677
(iii) race *mevania* Frühstorfer, 1910.	Gross-Glockner.	677
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(i) race *parthenoides* Keferstein, 1851.	Havre, Chartres and Auxerre.	679
(ii) race *completa* Verity, 1931.	Lardy, near Fontainebleau.	680
(iii) race *sphines* Frühstorfer, 1917.	Neighbourhood of Geneva, Gex (type).	680
(iv) race *beata* Caradja, 1894.	Valleys of the Pyrenees, near Bagnères de Luchon, Sost, St. Béat, 520 m.	681

Name.	Type Locality.	Page at which Discussed in Present Paper.
11. *Melitaea parthenoides* Keferstein—*continued.*		
(v) race *semiplena* Verity, 1931.	La Séreyrède, 1200–1300 m., on Mt. Aigoual, Cevennes.	681
(vi) race *plena* Verity, 1921.	Gèdre, Hautes-Pyrénées (not "Gironde" as stated in original description).	682
(vii) race *veletaensis* Ribbe, 1910. (syn.:—*nevadensis* Spuler, 1908).	Sierra Nevada (*Spuler*).	682
(viii) race *bolivari* Sagarra (1931).	Prov. Segovia, Sant Rafel.	683
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13. *Melitaea varia* Herrich-Schäffer, 1851.		685–689
(i) race *piana* Higgins, 1930.	Limone, Col di Tenda and Tenda, Alpes-Maritimes.	686
(ii) race *gilbon* Frühstorfer, 1917.	Neuveville, Jura.	687
(iii) race *variabella* Verity, 1931.	Clavières, 1800 m., Cottian Alps.	688
(iv) race *varia* Herrich-Schäffer, 1851.	Valais, Anderregg (*Herrich-Schäffer*).	688
(v) race *varissima* Verity, 1914.	Piano Astore near Bolognola in Sibillini Mts. in the Marche.	689

Alphabetical List of the Species, Exerges, Races, and Forms of Lower Status of the *athalia* Group of the Genus *Melitaea* Fabricius, 1807.

(Note :—Specific names are printed in capitals; the names of forms of lower status in italics. In the case of specific names, references are given both to the page where the description of the collective species begins and also to the page where the nominotypical race is described, where these are different.)

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Plate 1.

Note :—All the specimens figured on this plate are in the Verity collection, except where otherwise stated.

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14. „ „ ♂, Eastern Sayansk Mountains, 2600 m., Chulugaisha 600
15. „ „ ♀, „ „ „ 600

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COLLOTIPIA F.LLI ALINARI SOC. AN. - FIRENZE

Plate 2.

Note :—All the specimens figured on this plate are in the Verity collection.

Fig. No. Page

Melitaea athalia (Rottemburg) exerge *helvetica* Rühl (= *pseudathalia* Reverdin) (figs. 26–50).

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45. *M. a. sicula* Turati ♂, Mistretta, Messina (vi.) 617
46. „ „ ♀, Caronie Mountains, Sicily 617
47. *M. a. divergens* Rocci Gen. II *postdivergens* Rocci ♂, Turbigo, Milan (27.vii.) 618
48. *M. a. divergens* Rocci (Gen. I) ♂, Soria, Milan (10.vi.) . . . 618
49. „ „ ♀, „ (16.vi.) . . . 618
50. *M. a. hastensis* Rocci ♂, Casalborgone, Piedmont (viii.) . . . 619

COLLOTIPIA F.LLI ALINARI SOC. AN. - FIRENZE

Plate 3.

Note :—All the specimens figured on this plate are in the Verity collection.

Fig. No. Page

Melitaea athalia (Rottemburg) exerge *helvetica* Rühl (= *pseudathalia* Reverdin) (figs. 51–74).

51. *M. a. celadussa* Frühstorfer ♂, Limone, 1000 m., Maritime Alps (26.vii.) 619
52. „ „ ♀, Limone, 1000 m., Maritime Alps (1.viii.) 619
53. *M. a. luciflua* Frühstorfer ♂, Versoix, Geneva (21.vi.) (*Reverdin legit*) 620
54. „ „ ♀, Versoix, Geneva (23.v.) (*Reverdin legit*) 620
55. „ „ ♂, Vallon de Mardérique, Digne, Basses-Alpes (13.vii.) 620
56. „ „ ♀, Bé, Digne, Basses-Alpes (4.vi.) . . 620
57. *M. a. subluciflua* Verity ♂, Martigny, Valais (28.vi.). . . . 620
58. *M. a. subluciflua* Verity Gen. II *postsubluciflua* Verity ♂, Vence, Alpes-Maritimes (20.viii.) 620
59. *M. a. veragrorum* Verity ♂, Bex, Canton Vaud (30.vi.) . . . 621
60. „ „ ♀, „ „ (22.vi.) . . . 621
61. „ „ ♀, „ „ (8.vii.) . . . 621
62. *M. a. subhelvetica* Verity ♂, Wyler Ried, 1700 m., Lötschental (7.vi.) 621
63. „ „ ♀, Platten 621
64. *M. a. melida* Frühstorfer ♂, Laveno, Lake Maggiore (15.vi.) . . 621
65. „ „ ♀, „ „ (6.vi.) . . 621
66. „ „ ♀, „ „ (20.vi.) . . 621
67. *M. a. melida* Frühstorfer Gen. II *postmelida* Verity ♂, Laveno, Lake Maggiore (23.viii.) 621
68. *M. a. melida* Frühstorfer ♂, Civenna, Lake of Como (17.vi.) . . 621
69. *M. a. melangraphata* Beuret ♂, Fusio, 1300 m., Canton Tessin (15.vii.) 622
70. „ „ ♀, Bignasco, 400 m., Canton Tessin (vii.) 622
71. *M. a. helvetica* Rühl ♂, Stalla (Bivio), 2000 m., Albula Mountains, Canton Grisons (16.vii.) 623
72. „ „ ♀ (found *in copula* with the preceding) . . 623
73. „ „ ♂, Filisur, 1100 m., Albula Valley, Canton Grisons (vii.) 623
74. „ „ ♀, Filisur, 1100 m., Albula Valley, Canton Grisons (25.vii.) 623

Melitaea athalia (Rottemburg) synexergic races partaking of the characters both of exerge *helvetica* Rühl and of exerge *athalia* (Rottemburg) (figs. 75–77).

75. *M. a.* race *mixtalpicola* Verity ♂, Pontresina, 2000 m., Canton Grisons (14.vii.) 626
76. *M. a. mixtaceladussa* Verity ♂, Gèdre, 1000 m., Hautes-Pyrénées (15.vi.) 625
77. „ „ ♀, „ „ „ 625

COLLOTIPIA F.LLI ALINARI SOC. AN. - FIRENZE

Plate 4.

Note :—All the specimens figured on this plate are in the Verity collection.

Fig. No. Page

Melitaea athalia (Rottemburg) synexergic races partaking of the characters both of exerge *helvetica* Rühl (= *pseudathalia* Reverdin) and of exerge *athalia* (Rottemburg) (figs. 78–86).

78. *M. a. delminia* Frühstorfer ♂, Ortisei, 1200 m., Val Gardena, Upper Adige 627
79. „ „ ♀, „ „ „ 627
80. *M. a. benacensis* Verity ♂, Mount Baldo, Lake of Garda . . . 627
81. „ „ ♀, „ „ . . . 627
82. *M. a. microdelminia* Verity ♂, Mendola Pass, 1500 m., Upper Adige . 628
83. „ „ ♂, S. Valentino, 1500 m., Val Venosta, Upper Adige 628
84. *M. a. vividior* Gouin ♂, Gironde, St. Côme Bazas 628
85. „ „ ♂, Gironde, Villandraut 628
86. *M. a. vividior* Gouin Gen. II *postvividior* Verity ♂, Gironde, St. Côme Bazas 628

Melitaea athalia (Rottemburg) exerge *athalia* (Rottemburg), group with slender uncus (figs. 87–102).

87. *M. a. anatolica* Wagner ♂, Sultan Dagh, Anatolia (paratype) . . 631
88. *M. a. dejonides* Wagner ♂, Southern Russia (slide N. 6676 of Reverdin's files in the Geneva Museum) 632
89. *M. a. fiorii* Rocci ♂, Palmanova, Venetia 632
90. „ „ ♀, „ „ 632
91. *M. a. orientalpicola* Verity ♂, Carnic Alps, Sappada, 1200 m. . . 633
92. „ „ ♂, „ „ . . 633
93. „ „ ♂, „ „ . . 633
94. *M. a. parthenoidemima* Verity ♂, Western Bulgaria, Rilo Dagh, 1500 m. 634
95. „ „ ♂, Western Bulgaria, Mount Rilski, 1200 m. 634
95*bis*. *M. a. limera* Frühstorfer ♂, Western Bulgaria, Rilo Dagh, 1500 m. . 635
96. „ „ ♀, „ „ „ . 635
97. „ „ ♂, Macedonia, Mount Olympus, 1500 m. . 635
98. „ „ ♀, „ „ „ . 635
99. *M. a. diaminoides* Verity ♂, Herzegovina, Vucijabara . . . 635
100. „ „ ♂, Bukowina, Ropcea, Serath Valley (*Hormuzaki*) 635
101. „ „ ♀, Bukowina, Krasna (*Hormuzaki legit*) . 635
102. *M. a. caucasogenita* Verity ♂, " B. Altai, Juni '82 " 636

COLLOTIPIA F.LLI ALINARI SOC. AN. - FIRENZE

Plate 5.

Note :—All the specimens figured on this plate are in the Verity collection, except where otherwise stated.

Fig. No.		Page
	Melitaea athalia (Rottemburg) exerge *athalia* (Rottemburg), group with thick uncus (figs. 103–111*bis*).	
103.	*M. a. norwegica* Aurivillius ♂, Norway, "Dovre Feld, *Haas*" (paratype of *scandinavica* Staudinger in the Staudinger collection) . .	639
104.	„ „ ♀ (no locality)	639
105.	*M. a. athalia* (Rottemburg) ♂, Paris	643
106.	„ „ ♂, Bouray-et-Lardy, Dept. Seine-et-Oise, France	643
107.	„ „ ♀, Lardy, Dept. Seine-et-Oise . .	643
108.	*M. a. parvanigra* Verity ♂, Holland, Byvank	644
109.	„ „ ♀, „ „	644
110.	*M. a. britanna* Verity ♂, South Devon, Tavistock	645
111.	„ „ ♀, „ „	645
111*bis*.	„ „ ♂, „ „	645
	Melitaea coreae Verity (figs. 112–116).	
112.	*M. coreae* Verity ♂, Corea	646
113.	„ „ ♀, „	646
114.	„ „ ♀, „	646
115.	„ „ ♂ „ (Staudinger coll.)	646
116.	„ „ ♀, „ „	646
	Melitaea britomartis Assmann (group of races in which the genitalia is of a form found only in the far east of Asia) (figs. 117–126).	
117.	*M. b. centralasiae* Wnukowsky ♂, "Kentei, '89, Dorr." (paratype of *mongolica* Staudinger) . .	653
118.	„ „ ♂ (no locality) (Staudinger coll.) .	653
119.	„ „ ♂, Turkinsk White Mountains, 2000 m., Eastern Sayansk Mountains, Irkutsk Govt.	653
120.	„ „ ♂, „ „ „	653
121.	*M. b. seminigra* Seitz ♂, Turkinsk White Mountains, 2000 m., Eastern Sayansk Mountains, Irkutsk Govt. .	654
122.	„ „ ♀, „ „ „	654
123.	*M. b. menetriesi* Caradja ♂, Pokrowsk, W. Amur	654
124.	*M. b. septentriorientis* Verity ♂, Kamtchatka	654
125.	„ „ ♂, „	654
126.	„ „ ♂, „	654
	Melitaea britomartis Assmann (group of races in which the genitalia is of a form found also in races extending westwards to Europe (figs. 127–131*bis*).	
127.	*M. b. frigidaltaica* Verity ♂, Central Altai Mountains . . .	656
128.	„ „ ♂, „ „ . . .	656
129.	„ „ ♂, „ „ . . .	656
130.	*M. b. amurensis* Staudinger ♂, Raddejewka, central Amur . .	657
131.	„ „ ♀ (no locality) (Staudinger coll.) . .	657
131*bis*.	„ „ ♀, Ussuria	657

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Plate 6.

Note :—All the specimens figured on this plate are in the Verity collection.

Fig. No.		Page
	Melitaea britomartis Assmann (figs. 132–146).	
132.	*M. b. plotina* Bremer ♂, Chulugaisha, 2600 m., Mondy, Eastern Sayansk Mountains	658
133.	„ „ ♂, „ „ „	658
134.	„ „ ♀, Arasan, 2000 m., Altai	658
135.	*M. b. imitans* Verity ♂, Chulugaisha, 2600 m., Mondy, Eastern Sayansk Mountains	659
136.	„ „ ♀, „ „ „	659
137.	*M. b. aureliaeformis* Verity ♂, Venaria Reale, Turin	661
138.	„ „ ♀, „ „	661
139.	„ „ ♂, „ „	661
140.	*M. b. melathalia* Rocci ♂, Galliate, Milan (16.v.)	663
141.	„ „ ♂, „ „	663
142.	„ „ ♀, „ „	663
143.	*M. b. melathalia* Rocci Gen. II *postmelathalia* Rocci ♂, Turbigo, Milan (27.vii.)	663
144.	*M. b. melathalia* Rocci Gen. II *postmelathalia* Rocci ♂, Turbigo, Milan (27.vii.)	663
145.	*M. b. melathalia* Rocci Gen. II *postmelathalia* Rocci ♀, Soria, Milan (24.vii.)	663
146.	*M. b. melathalia* Rocci Gen. II *postmelathalia* Rocci ♀, Galliate, Milan	663
	Melitaea parthenie (Borkhausen) (= *M. aurelia* Nickerl) (figs. 147–165, 165*bis*).	
147.	*M. p. nigrobscura* Verity ♂, Chiapovano, 800 m., Gorizia, Udine	666
148.	„ „ ♂, „ „ „	666
149.	„ „ ♀, „ „ „	666
150.	*M. p. micromelanica* Verity ♂, Sierre, Canton Valais	667
151.	„ „ ♀, „ „	667
152.	*M. p. vividocolore* Verity ♂, Kisnyir, Hungary (holotype)	668
153.	*M. p. aurelia* Nickerl ♂, Vienna	668
154.	„ „ ♀, „	668
155.	*M. p. parthenie* (Borkhausen) ♂, Dresden	668
156.	„ „ ♂, Plateau St. Claude, Moreuil, Dept. Oise (holotype of *lucasi* Verity)	668
157.	„ „ ♀, „ „ „	668
158.	*M. p. rhaetica* Frey ♂, Grisons	669
159.	*M. p. poenina* Verity ♂, Bérisal, Simplon, Canton Valais	669
160.	„ „ ♂, „ „ „	669
161.	„ „ ♂, „ „ „	669
162.	„ „ ♀, „ „ „	669
163.	*M. p. carsicola* Verity ♂, Opcina, 300 m., Carso Trieste (23.v.)	670
164.	„ „ ♂, „ „ „	670
165.	*M. p. carsicola* Verity Gen. II *postcarsicola* Verity ♂, Opcina, 300 m., Carso Trieste (25.vii.)	670
165*bis*.	*M. p. carsicola* Verity Gen. II *postcarsicola* Verity ♂, Opcina, 300 m., Carso Trieste (25.vii.)	670

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Plate 7.

Note :—All the specimens figured on this plate are in the Verity collection, except where otherwise stated.

Fig. No. Page

Melitaea parthenie (Borkhausen) (= *M. aurelia* Nickerl) (figs. 166–171).

166. *M. p. mussinae* Costantini ♂, La Mussina, Emilian Apennines (vi.) . 670
167. „ „ ♀, Monte Gibbio, Modena, Emilia (2.vii.) 670
168. *M. p. imitatrix* Verity ♂, Oulx, 1100 m., Susa Valley, Piedmont . 671
169. „ „ ♂, Turin 671
170. *M. p. verbanica* Rocci ♂, Valtravaglia, 800 m., Lake Maggiore (30.vi.) 671
171. „ „ ♀, „ „ (8.vii.) 671

Melitaea asteria Freyer (figs. 172–174).

172. *M. a. asteria* Freyer ♂, Col du Julier, 2400 m., Upper Engadine . 677
173. „ „ ♀, „ „ „ . 677
174. „ „ ♂, „ „ „ . 677

Melitaea parthenoides Keferstein (= *M. parthenie* (Borkhausen), auct. *nec* (Borkhausen)) (figs. 175–191, 193–195).

175. *M. p. parthenoides* Keferstein ♂, Pont de l'Arche, Dept. Eure (type of *inanis* Verity) 679
176. „ „ ♀, „ „ „ 679
177. *M. p. parthenoides* Keferstein Gen. I *communis* Verity ♂, Angers, Dept. Maine-et-Loire 679
178. *M. p. parthenoides* Keferstein Gen. I *communis* Verity ♀, Angers, Dept. Maine-et-Loire 679
179. *M. p. parthenoides* Keferstein Gen. I *communis* Verity ♂, St. Martin-Vésubie, Alpes-Maritimes. 679
180. *M. p. completa* Verity ♂, Lardy, Dept. Seine-et-Oise . . . 680
181. *M. p. sphines* Frühstorfer ♂, Bois des Frères, Geneva (7.viii.) . . 680
182. „ „ ♀, Versoix, Geneva (7.viii.) . . . 680
183. *M. p. beata* Caradja ♂, St. Côme Bazas, Gironde (20.v.) . . . 681
184. „ „ ♀, „ „ (4.v.) . . . 681
185. *M. p. beata* Caradja form *austera* Verity ♀, Barcelona . . . 681
186. „ „ „ ♂, „ . . . 681
187. *M. p. semiplena* Verity ♂, Le Séreyrède, 1200 m., Mt. Aigoual, Cevennes (12.vi.) 681
188. „ „ ♀, „ „ „ 681
189. *M. p. plena* Verity ♂, Gèdre, Hautes-Pyrénées 682
190. „ „ ♀, „ „ 682
191. „ „ ♂, „ „ 682
(192. *See below.*)
193. *M. p. bolivari* Sagarra ♂, Sant Rafel, 1300 m., Segovia, Old Castile . 683
194. „ „ ♀, „ „ „ . 683
195. *M. p. veletaensis* Ribbe ♂, Orihuela, 1700 m., Aragon . . . 682

Melitaea alatavica Staudinger (figs. 192, 196, 197).

192. *M. alatavica* Staudinger ♂, Dscharkent (in *Coll. Hamburgisches Museum*) 683
196. „ „ ♂, "Kuldja, 1885," Dzungarian Ala-tau 683
197. „ „ ♀, „ „ „ 683

66 169

70 173

74 177

78 181

82 185

86 189

90 195

96 199

00 203

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Fig. No. Page

Melitaea varia Herrich-Schäffer (figs. 198–203).

198. *M. v. varia* Herrich-Schäffer ♂, Stelvio Pass, 3000 m., Ortler, Upper Adige 688
199. „ „ ♀, Muottas, 2600 m., Pontresina Engadine 688
200. *M. v. variabella* Verity ♂, Clavières, 1800 m., Cottian Alps . . 688
201. „ „ ♀, „ „ . . 688
202. *M. v. piana* Higgins ♂, St. Martin-de-Vésubie, 2000–2300 m., Alpes-Maritimes 686
203. „ „ ♀, „ „ „ . 686

Plate 8.

Note :—The specimens figured on this plate are in the Paris Natural History Museum, mostly in the Frühstorfer collection. The specimens indicated as types are so labelled by Frühstorfer himself. A few of the examples figured are (as shown) in the Heyne collection.

Fig. No. Page

Melitaea deione (Geyer) (figs. 204–206).

204. *M. d. phaisana* Frühstorfer ♂, " Nord Italien " (cotype of *rafaëla* Frühstorfer) 604
205. „ „ ♀, „ „ „ 604
206. *M. d. vesubiana* Verity ♀, " Alp. Marit., Tenda, vii.08. Dr. v. Cube coll." 603

Melitaea ambigua Ménétriés (figs. 207–209, 213, 214).

207. *M. a. niphona* Butler ♂ (no locality) (type of *bathilda* Frühstorfer) . 598
208. „ „ ♂, " Amur Radde 1903 Korb " (paratype of *bathilda* Frühstorfer) 598
209. *M. a. nossis* Frühstorfer ♂ (no locality) (Type) 598
213. *M. a. kenteana* Seitz ♂, " Transbaikal " (Heyne coll.) . . . 599
214. „ „ ♀, „ „ . . . 599

Melitaea athalia (Rottemburg) (figs. 210–212, 215–227).

210. *M. a. tinica* Frühstorfer ♂, " Irkutsk " (Type) 639
211. „ „ ♂, „ „ 639
212. „ „ ♀, „ „ 639
(213–214. *See above.*)
215. *M. a. noctula* Frühstorfer ♂, " Erstfeldthal 21.vii.09 " (Type). . . 623
216. „ „ ♂, " Glärnisch August " (paratype) . . 623
217. „ „ ♂, „ „ „ . . 623
218. „ „ ♀, „ „ „ . . 623
219. „ „ ♀, „ „ „ . . 623
220. *M. a. caucasogenita* Verity ♂ (no locality) (Heyne coll.) . . . 636
221. „ „ ♀, " Caucas." „ . . . 636
222. *M. a. lucifuga* Frühstorfer ♂, " Saratow " (Type) 636
223. „ „ ♂, „ (paratype) . . . 636
224. „ „ ♂, „ „ . . . 636
225. *M. a. lachares* Frühstorfer ♂, " Schweden 15.vii." (Type) . . 640
226. „ „ ♀, „ (paratype) . . 640
227. *M. a. scardona* Frühstorfer ♂, " Agram " (Type) 641

COLLOTIPIA F.LLI ALINARI SOC. AN. - FIRENZE

Plate 9.

Note :—The specimens figured on this plate are in the Paris Natural History Museum, mostly in the Frühstorfer collection. The specimens indicated as types are so labelled by Frühstorfer himself. A few of the examples figured are (as shown) in the Heyne collection.

Fig. No.		Page
	Melitaea athalia (Rottemburg) (figs. 228–238, 240, 241).	
228.	*M. a. scardona* Frühstorfer ♂, "Agram" (paratype)	641
229.	*M. a. limera* Frühstorfer ♂, "Bosnia Koricna (Leonhard)"	635
230.	„ „ ♂, „ „	635
231.	„ „ ♀, „ „ (Type)	635
232.	„ „ ♀, "Bosnia Trabwic"	635
233.	*M. a. boris* Frühstorfer ♀, "Bulg. Rhodope Geb. (Leonhard)" (Type)	643
234.	*M. a. mehadiensis* Gerhard ♂, "Mehadia" (Heyne coll.)	642
235.	„ „ ♂, "Hungar." „	642
236.	„ „ ♀, „ „	642
237.	*M. a. suessula* Frühstorfer ♂, "Rohrseemoos Kchelsee 7.vii.06" (Type)	634
238.	„ „ ♂, "Rohrseemoos Schledorf 17.vii.06" (paratype)	634
(239.	*See below.*)	
240.	*M. a. caucasogenita* Verity ♂, "Caucasus" (Heyne coll.)	636
241.	„ „ ♀, "Caucas. Achalzikh" (Heyne coll.)	636
	Melitaea britomartis Assmann (fig. 239).	
239.	*M. b. marussia* Frühstorfer ♂, "Saratow" (Type)	659
	Melitaea parthenie (Borkhausen) (= *M. aurelia* Nickerl) (figs. 242–251).	
242.	*M. p. luceria* Frühstorfer ♂, "Cogne" (paratype)	670
243.	„ „ ♂, „ „	670
244.	„ „ ♂, „ (Type)	670
245.	*M. p. valsunga* Frühstorfer ♂, "Barmsee 1904" (Type)	667
246.	„ „ ♀, „ (paratype)	667
247.	*M. p. mendrisiota* Frühstorfer ♂, "San Giorgio 13.viii.18"	672
248.	„ „ ♂, „ „	672
249.	„ „ ♂, "Lugano" (Type)	672
250.	„ „ ♀, „ (paratype)	672
251.	„ „ ♀, "San Giorgio 4.vi.18"	672
	Melitaea varia Herrich-Schäffer (figs. 252–253).	
252.	*M. v. gilbon* Frühstorfer ♂, "Neuveville Juni 1906" (Type)	687
253.	„ „ ♀, „ „ (paratype)	687

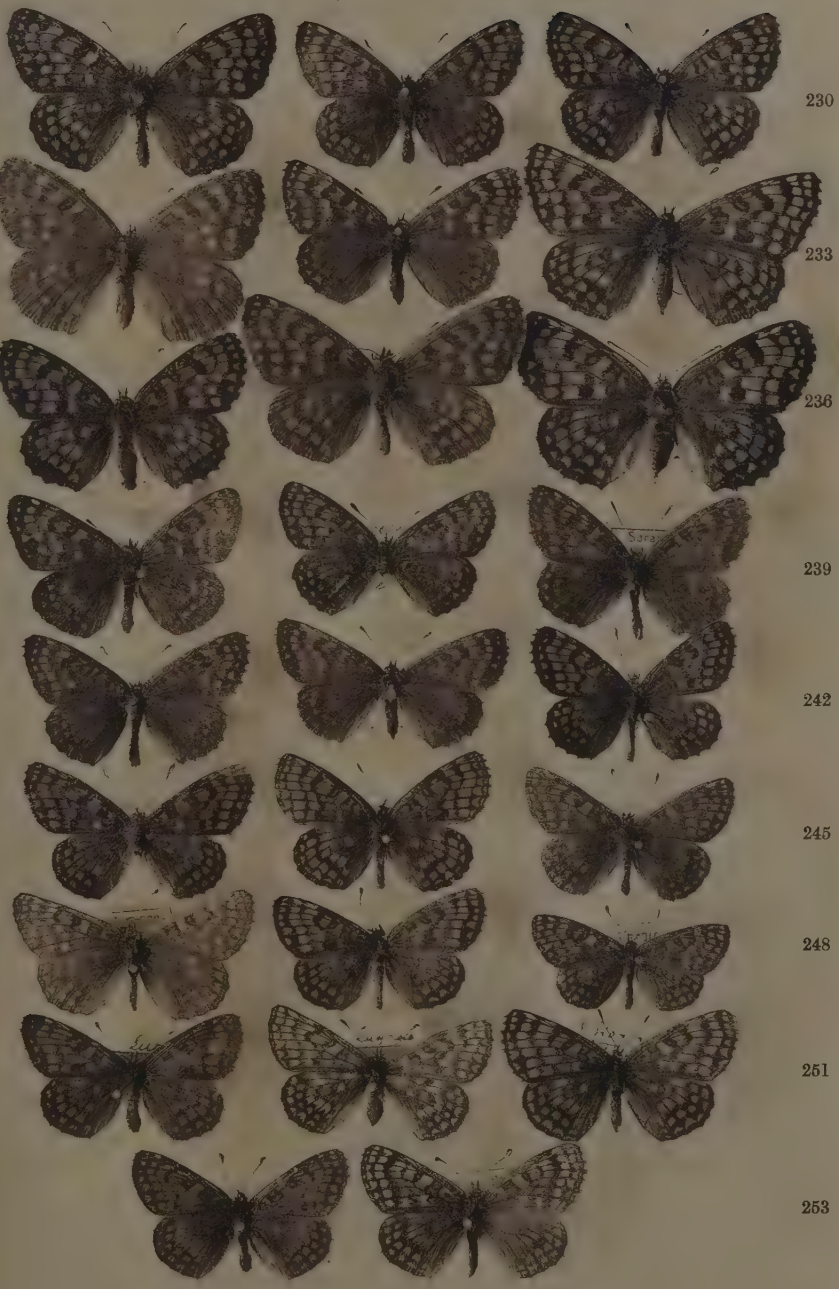

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Plate 10.

Male Genital Armatures.

Note :—In the majority of cases, the dissections figured on this plate have been prepared from specimens figured on earlier plates. In these cases, a reference is given only to the plate and figure concerned, since full particulars have been given there regarding the locality in which the specimen was captured. In the remaining cases, the locality in which the specimen dissected was captured is given below.

Fig. No.		Page
	Melitaea pacifica Verity (fig. 254).	
254.	*M. p. pacifica* Verity (pl. 1, fig. 1)	595
	Melitaea ambigua Ménétriés (figs. 255–262).	
255.	*M. a. niphona* Butler (pl. 1, fig. 4)	598
256.	*M. a. niphona* Butler (= *mandschurica* Fixsen) (pl. 1, fig. 5) . .	598
257.	*M. a. ambigua* Ménétriés (pl. 1, fig. 7)	599
258.	*M. a. kenteana* Seitz (trans ad *ambigua* Ménétriés) (pl. 1, fig. 10) .	599
259.	*M. a. kenteana* Seitz (pl. 8, fig. 213)	599
260.	*M. a. kenteana* Seitz form *crassepicta* Verity (pl. 1, fig. 11) . .	599
261.	*M. a. sayanskalpina* Verity (pl. 1, fig. 14)	600
262.	„ „ (pl. 1, fig. 13)	600
	Melitaea deione (Geyer) (figs. 263–266).	
263.	*M. d. deione* (Geyer) form *praestantior* Verity : Marseilles . .	603
264.	*M. d. rondoui* Oberthür (pl. 1, fig. 18)	605
265.	*M. d. phaisana* Frühstorfer : Ponte all'Isarco, Upper Adige . .	604
266.	*M. d. berisalii* Rühl (pl. 1, fig. 20)	605
	Melitaea athalia Rottemburg exerge *helvetica* Rühl (figs. 267–271).	
267.	*M. a. asiae* Verity (pl. 1, fig. 21)	612
268.	*M. a. asiae* Verity form *asiaefrigida* Verity (pl. 1, fig. 25) . .	612
269.	*M. a. iberanana* Verity Gen. I *biedermanni* Querci (pl. 2, fig. 26) .	613
270.	*M. a. iberanana* Verity (Gen. II) (pl. 2, fig. 28)	613
271.	*M. a. submaxima* Verity : Sestri Levante, Liguria	617

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Plate 11.

Note :—In some cases, the dissections figured on this plate have been prepared from specimens figured on earlier plates. In these cases, a reference is given only to the plate and figure concerned, since full particulars have been given there regarding the locality in which the specimen was captured. In the remaining cases, the locality in which the specimen dissected was captured is given below.

Fig. No. Page

Melitaea athalia (Rottemburg) (figs. 272–289).

Exerge *helvetica* Rühl (figs. 272–277).

272. *M. a. divergens* Rocci ab. *uncummimans* Verity : Turbigo, Milan . 612
273. *M. a. veragrorum* Verity : Soglio, Val Bragaglia, Rhaetian Alps . 621
274. *M. a. melida* Frühstorfer : Laveno, Lake Maggiore . . . 621
275. „ „ Civenna, Lake Como 621
276. *M. a. helvetica* Rühl (pl. 3, fig. 71) 623
277. *M. a. noctula* Frühstorfer (pl. 8, fig. 215) 623

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279. *M. a. delminia* Frühstorfer : Pinzolo, Trentino, Upper Adige . . 627
280. *M. a. benacensis* Verity : Mount Baldo, Lake Garda . . . 627
281. *M. a. vividior* Gouin : St. Côme, Gironde (slide No. 7877 of Reverdin's files in the Geneva Museum) 628
282. „ „ „ 628
283. „ „ „ 628

Exerge *athalia* (Rottemburg).

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284. *M. a. anatolica* Wagner (pl. 4, fig. 87) 631
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286. *M. a. fiorii* Rocci : Palmanova, Venetia 632
287. *M. a. orientalpicola* Verity (pl. 4, fig. 91) 633
288. *M. a. parthenoidemima* Verity (pl. 4, fig. 94) 634
289. *M. a. limera* Frühstorfer (pl. 4, fig. 95*bis*) 635

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Plate 12.

Note :—In the majority of cases, the dissections figured on this plate have been prepared from specimens figured on earlier plates. In these cases, a reference is given only to the plate and figure concerned, since full particulars have been given there regarding the locality in which the specimen was captured. In the remaining cases, the locality in which the specimen dissected was captured is given below.

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	Melitaea athalia (Rottemburg) (figs. 290–303).	
	Group with slender uncus (figs. 290–295).	
290.	*M. a. diaminoides* Verity (pl. 4, fig. 100)	635
291.	„ „ Tetina, Bukowina, *Hormuzaki legit*	635
292.	„ „ (pl. 4, fig. 99)	635
293.	*M. a. lucifuga* Frühstorfer (pl. 8, fig. 222)	636
294.	*M. a. caucasogenita* Verity (pl. 8, fig. 220)	636
295.	„ „ (pl. 4, fig. 102)	636
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296.	*M. a. tinica* Frühstorfer (pl. 8, fig. 211).	639
297.	*M. a. lachares* Frühstorfer (pl. 8, fig. 225)	640
298.	*M. a. norwegica* Aurivillius (pl. 5, fig. 103)	639
299.	*M. a. scardona* Frühstorfer (pl. 8, fig. 227)	641
300.	„ „ Carso plateau, above Trieste	641
301.	*M. a. mehadiensis* Gerhard (pl. 9, fig. 634).	642
302.	*M. a. athalia* (Rottemburg) (pl. 5, fig. 105)	643
303.	*M. a. britanna* Verity (pl. 5, fig. 110)	645
	Melitaea coreae Verity (figs. 304, 305).	
304.	*M. coreae* Verity (pl. 5, fig. 112)	646
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	Melitaea britomartis Assmann.	
	Group of races with genitalia of type found only in the Far East (figs. 306, 307).	
306.	*M. b. centralasiae* Wnukowsky (= *mongolica* Staudinger) (pl. 5, fig. 117)	653
307.	„ „ (pl. 5, fig. 118)	653

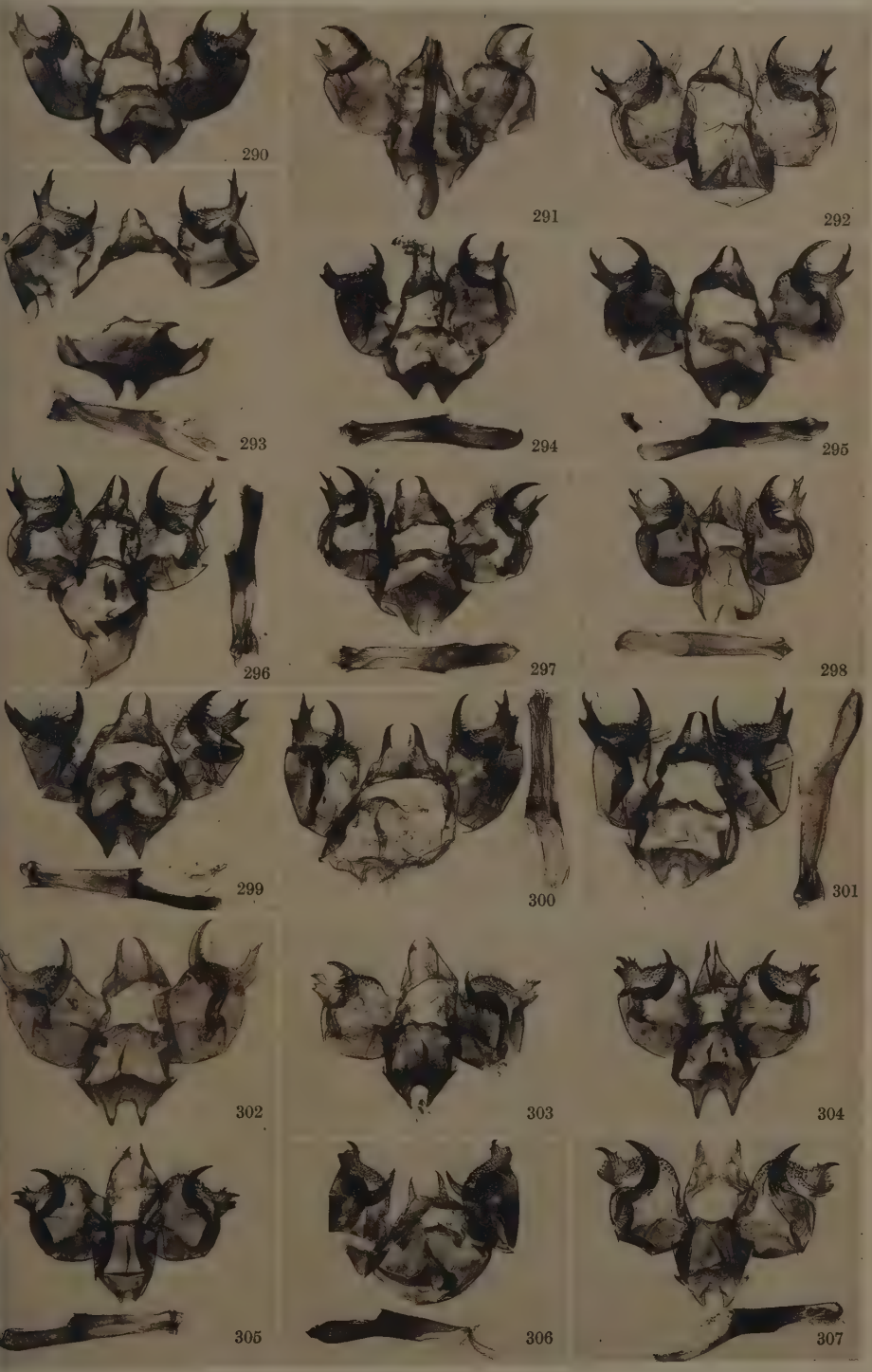

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Plate 13.

Note :—In the majority of cases, the dissections figured on this plate have been prepared from specimens figured on earlier plates. In these cases, a reference is given only to the plate and figure concerned, since full particulars have been given there regarding the locality in which the specimen was captured. In the remaining cases, the locality in which the specimen dissected was captured is given below.

Fig. No. Page

Melitaea britomartis Assmann (figs. 308–317).

Group of races with genitalia of type found only in the Far East (figs. 308–311).

308. *M. b. centralasiae* Wnukowsky (= *mongolica* Staudinger) (pl. 5, fig. 119) 653
309. *M. b. seminigra* Seitz (pl. 5, fig. 121) 654
310. *M. b. menetriesi* Caradja (= *orientalis* Ménétriés) (pl. 5, fig. 123) . 654
311. *M. b. septentriorientis* Verity : Kamchatka 654

Group of races with genitalia of type which extends westward to Europe (figs. 312–317).

312. *M. b. frigidaltaica* Verity (pl. 5, fig. 127) 656
313. *M. b. amurensis* Staudinger (pl. 5, fig. 130) 657
314. *M. b. plotina* Bremer (pl. 6, fig. 132) 658
315. *M. b. marussia* Frühstorfer (pl. 9, fig. 239) 659
316. *M. b. aureliaeformis* Verity (pl. 6, fig. 137) 661
317. *M. b. melathalia* Rocci : Turbigo, Lombardy 663

Melitaea parthenie (Borkhausen) (= *aurelia* Nickerl) (figs. 318–325).

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319. *M. p. valsunga* Frühstorfer (pl. 9, fig. 245) 667
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325. „ „ Mount Musinè (foot of Susa Valley) . . 671

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Plate 14.

Note :—In the majority of cases, the dissections figured on this plate have been prepared from specimens figured on earlier plates. In these cases, a reference is given only to the plate and figure concerned, since full particulars have been given there regarding the locality in which the specimen was captured. In the remaining cases, the locality in which the specimen dissected was captured is given below.

Fig. No. Page

Melitaea parthenie (Borkhausen) (= *aurelia* Nickerl) (figs. 326–328).

326. *M. p. imitatrix* Verity (pl. 7, fig. 169) 671
327. *M. p. mendrisiota* Frühstorfer (pl. 9, fig. 247) 672
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Melitaea asteria Frey (figs. 329, 330).

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330. *M. a. rebeli* Wnukowsky (= *altaica* Staudinger) : High Tchuja Mountains, 2100–1400 m., Altai 676

Melitaea parthenoides Keferstein (= *parthenie* Borkhausen, auct. *nec* Borkhausen) (figs. 331–336).

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332. „ „ Gen. I form *communis* Verity (pl. 7, fig. 179) 679
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